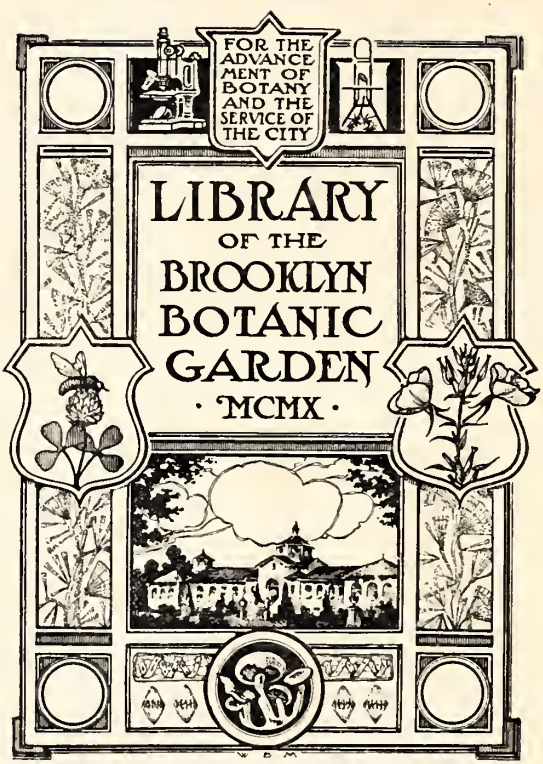


BROOKLYN BOTANIC GARDEN

LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES V | BROOKLYN, N. Y., APRIL 4, 1917. | No. 1

SUMMER COURSES FOR TEACHERS OF GARDENING*

July 5 to August 16, 1917

There is an increasing demand for persons adequately prepared to become teachers or supervisors of garden work for both children and adults, but opportunities to secure the necessary preparation are not numerous. As in other cases where special problems are to be met and solved, an interest in children, a mere liking for the work, or even native teaching ability, while highly essential, are not, in themselves, sufficient to insure success.

The following courses are planned to acquaint the prospective teacher with some of the main problems to be met with in this work, and such effective solutions of them as have been worked out in practice. *These courses are considered as a unit, and are not offered separately.* College and normal school graduates are eligible for these courses. Successful teaching experience, properly certified to, will be accepted in place of college or normal school diplomas.

The *fee for the entire course is Twenty Dollars.* Even though credit be given for work done elsewhere, the minimum charge for a certificate will in any case be Fifteen Dollars.

To those who satisfactorily complete the work, a Certificate in Gardening will be granted.

***Full Prospectus of all courses offered throughout the year may be had on application. Address: The Secretary, Brooklyn Botanic Garden, Brooklyn, N. Y.**

B 1. Soils and Agricultural Principles.—A study of soils; fertilizers, natural and chemical; relation of water and air to soil; liming; mixing of soils and tillage. Five lectures with laboratory work. *Friday afternoons, from 2 to 3, July 6-August 3.*

Miss Shaw.

B 2. Elementary Botany.—A survey of general physiological and morphological principles, illustrated by a few of the more important types of plants. Lectures and demonstrations in laboratory and greenhouse. *Tuesday, Wednesday and Friday, 3 to 5 p. m., July 6-31.* Dr. Olive.

B 3. Garden Practice.—Practice work with a class of children or adults, including such topics as planning and making the garden, laying out of grounds, preparation of soil, seed sowing, transplanting, cropping, cultivation, school garden management, improvement of home and school grounds, preparation of exhibits. Lectures and outdoor practice work. *Tuesday, Wednesday, Thursday, Friday, 10:30 to 11:30, July 6 to August 16.*

Miss Shaw and Miss Cross.

B 4. Plant Propagation and Greenhouse Work.—Methods of plant propagation, care of plants, cuttings, raising of seedlings for the outdoor garden. Work related to children's gardens. Laboratory work. *Wednesdays, from 3 to 5 p. m., August 1, 8, 15.*

Miss Shaw and Miss Cross.

B 5. Nature Study.—Nature in relation to gardens and plant life. Topics: plant structure; fruit and fruit formation; weeds; weed dispersal; insect pests; birds in their relation to agriculture; garden friends; shrubs; shade and lawn trees. Credit will be given for this course in Nature Study on presentation of a satisfactory certificate of similar work done at any other accredited institution. Hours to be arranged. Miss Cross.

B 6. Fungous and Insect Pests.—Two lectures and demonstrations on the occurrence of, and methods of combating the commoner fungous and insect pests of garden and greenhouse plants. *August 3 and 7, 3 to 5 p. m.* Mr. Free.

B 8. Pedagogy of Botany.—A brief discussion of the mental processes involved in learning and teaching science, and the fundamental principles which underlie and point the way to laboratory and field work. Three lectures. *Wednesdays, from 2 to 3 p. m., July 11, 18, 25.* DR. GAGER.

B 9. Genetics.—Four lectures on the problems of heredity, variation, and environment, and their bearing on education; illustrated by demonstration material obtained from plant-breeding experiments, and by lantern slides. Lecture subjects: Kinds and extent of variation in plants and animals; How characters are inherited; Sex in plants and the methods in crossing; Human heredity. *Wednesdays, from 2 to 3 p. m., August 1, 8, 15.* DR. WHITE.

B 10. Woodwork.—The construction of simple garden apparatus, such as window boxes, flats, sieves, tampers, dibbers, etc. *Thursdays, 1 to 3, July 5, 12, 19, 26.* MR. STOLL.

B 11. Practical Garden Work.—Work with children in a garden under supervision. This work must be done at the Brooklyn Botanic Garden. *Tuesday to Saturday mornings, from 9 to 10:30; afternoons, except on Saturdays and Mondays, July 6 to August 15.*

NOTICES

The Garden is open free to the public daily, from 8 a. m. until dark; on Sundays and holidays at 10 a. m. The Laboratory Building, containing the library, herbarium, and offices, is open daily, from 9 a. m. until 5 p. m. The Conservatories are open April 1–October 1, 10 a. m.–4:30 p. m.; October 1–April 1, 10 a. m.–4 p. m.

The Garden may be reached by Flatbush Avenue trolley to Malbone Street; Franklin Avenue and Lorimer Street trolleys to Washington Avenue; St. John's Place trolley to Sterling Place; Ninth Avenue, Sixteenth Avenue, Union Street, Greenpoint and Smith Street trolleys to Prospect Park Plaza and Union Street, and Brighton Beach elevated to Consumers' Park Station. (The elevated trains stop only when the conductor is notified in advance.)

A docent will meet parties by appointment and conduct them through the Garden. This service is free to members of the Botanic Garden and to teachers with classes; to others there is a nominal charge of 25 cents an hour for parties of less than three, and 10 cents a person per hour for parties of three or more.

Current numbers of LEAFLETS are free to all who wish them. Back series, complete, 50c. each; single numbers, 5c. each.

The LEAFLETS are published weekly or biweekly from April to June, and September to October, inclusive, by The Brooklyn Institute of Arts and Sciences, at Washington Avenue and Montgomery Street, Brooklyn, N. Y.

Telephone: 6173 Prospect.

Mail address: Brooklyn Botanic Garden, Brooklyn, N. Y.

SCHOOL NUMBER

BROOKLYN BOTANIC GARDEN

LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES V BROOKLYN, N. Y., APRIL 11, 1917. No. 2

LIST OF TALKS FOR ELEMENTARY SCHOOL CLASSES

The following list of talks is the fifth offered at the Brooklyn Botanic Garden. It differs very little from those preceding it. The Botanic Garden can accomodate more children this year than ever before in its history. The lecture hall will be completed by the time these talks start and this means that where, for the past seasons, we have been able to accomodate less than one hundred children at one time, we can now seat many more.

The seating capacity of the auditorium is over five hundred. We do not recommend that five hundred children come at one time unless it be with a distinct understanding that they can receive only a limited amount of attention. Five hundred children can all listen to a talk on rice, for instance, and see the pictures at one time, but it will be impossible for us to divide the five hundred into small enough groups so that the individual child gets very much from a trip through the greenhouses. Heretofore, it has been possible to have a teacher for each group of fifteen or twenty children. This means that as these children walk through the greenhouses they get individual attention and instruction, and if they go out upon the grounds to study trees or wild flowers, they are receiving the benefit of a private lesson. This method of giving individual instruction has always made the trips to the Botanic Garden of special educational value. As groups increase in size, the value of the work decreases in about geometric proportions, so while we can accomodate groups of five hundred we do not recommend that schools should send children in any such numbers when the lecture is to be followed by demonstrations.

When a teacher gives up a half day for a trip to the Botanic Garden, she should expect that the children would receive a great deal from such a trip in the form of subject matter that she could work on in her nature study for some lessons to come.

The statement of facts concerning numbers is not intended to exclude numbers but to encourage, as far as possible, the coming of smaller groups for intensive work.

There is a new subject added this spring to the list of talks, entitled "How to make your back yard work for you". This present season when the prices of foods are soaring, it seems as if all the boys and girls should, as far as possible, work whatever areas of land they can get possession of. The governments in France and Germany are setting the children of those countries a task for the summer; that task is to till the land. As far as possible let us bring such a subject as this before the attention of the boys and girls of our own country.

These talks will be given during school hours from April 30 to June 1, 1917.

TALKS TO BE GIVEN AT THE BOTANIC GARDEN

Grades 3A and 3B

1. Common wild flowers in bloom. (Wild Flower Garden, May-June).
2. Common trees. (Field trip, in the Garden).
3. Seeds and seedlings. (Experiments).
4. Methods of propagating plants. (Greenhouse).
5. Formation of soil. (Demonstration).

Grades 4A and 4B

6. Cultivation of plants by slips, seeds, etc. (Greenhouse).
7. The cultivation of rice in Japan and China. (Lantern slides).
8. Some useful plants of sub-tropical climates. (Lantern slides and living plants).

Grades 5A and 5B

9. Plants useful to man. (Lantern slides and living plants).
10. Trees: blossom and fruit formation. (Botanic Garden grounds, May-June).
11. Common shade trees. (Botanic Garden grounds, May-June).
12. Evergreen and deciduous trees. (Botanic Garden grounds, May-June).
13. Food plants raised in the United States. (Lantern slides).
14. Plant industries and products of the United States. (Lantern slides).
15. Cotton raising in the South. (Lantern slides).

Grades 6A and 6B

16. Coffee culture in South America. (Lantern slides and living plants).
17. The rubber industry in South America. (Lantern slides and living plants).

GRADES 7A AND 7B

18. Agricultural products of the United States. (Lantern slides).
19. Some agricultural products of the Orient. (Lantern slides).

ALL GRADES

20. How to make a garden and prepare for the Annual Children's Garden Exhibit, to be held at the Botanic Garden, September 14 and 15, 1917.
21. A more beautiful Brooklyn.
22. How to make your back-yard work for you.

NOTE:—The above talks, except the last group, will be given only at the Brooklyn Botanic Garden, where the greenhouses, economic plants and the grounds make it possible to acquaint the children with the living material. Principals and teachers should make appointments for classes at least three days in advance. These talks are listed by grades to correlate with the city syllabus in nature study and geography. Any talk will be given to any class of either public or private schools, regardless of this grading. Talks 20-22 will be given also at any school on request.

There may be other talks on botanical subjects and nature study which teachers desire, and which do not appear on the above list. Such talks as far as possible, will be given on application by the teacher. All applications should be in writing on cards provided by the Garden for the purpose. These cards read as follows:

School .....Grade..... No. of pupils ... ..
Address ....
Date of request..... .....
The Assistant Curator of Public Instruction

BROOKLYN BOTANIC GARDEN

I wish to bring my class, as indicated above, to the Botanic Garden on date..... .....at hour.....
for purposes checked below:

1. Talk No..... ....for Elementary School Classes
2. A special talk on..... ....
3. Special work in the plant houses.
4. Visit the conservatories under guidance.
5. Visit the out-of-doors collections under guidance.
6. Visit the Japanese Garden.

School telephone.....Teacher

(*Additional copies of this card may be had on application*)

ELLEN EDDY SHAW.

DEDICATION MEETINGS

In connection with the dedication of the completed laboratory building, special exercises will be held on Friday and Saturday, April 20 and 21. There will be sessions for the reading of scientific papers on Friday and Saturday mornings at 10:30, and on Friday afternoon at 2 o'clock.

On Friday evening, at 8:15, there will be a popular scientific program in the lecture hall of the building. The new building will be open for inspection from 7:30 to 8:15 and from 9:45 to 11 p. m.

PROGRAM FOR FRIDAY EVENING, AT 8:15

1. The use of the microscope in detecting adulterants in foods and drugs.
   By Prof. H. H. Rusby, *Dean of the College of Pharmacy, Columbia University.*
2. Problems of Conservation in New York State.
   By Hon. George D. Pratt, *Commissioner of Conservation of New York State.*
3. Photographing wild flowers for color illustration.
   By Dr. Homer D. House, *State Botanist of New York.*

The public is cordially invited to all these sessions.

NOTICES

The Garden is open free to the public daily, from 8 a. m. until dark; on Sundays and holidays at 10 a. m. The Laboratory Building, containing the library, herbarium, and offices, is open daily, from 9 a. m. until 5 p. m. The Conservatories are open April 1–October 1, 10 a. m.–4:30 p. m.; October 1–April 1, 10 a. m.–4 p. m.

The Garden may be reached by Flatbush Avenue trolley to Malbone Street; Franklin Avenue and Lorimer Street trolleys to Washington Avenue; St. John's Place trolley to Sterling Place; Ninth Avenue, Sixteenth Avenue, Union Street, Greenpoint and Smith Street trolleys to Prospect Park Plaza and Union Street, and Brighton Beach elevated to Consumers' Park Station. (The elevated trains stop only when the conductor is notified in advance.)

A docent will meet parties by appointment and conduct them through the Garden. This service is free to members of the Botanic Garden and to teachers with classes; to others there is a nominal charge of 25 cents an hour for parties of less than three, and 10 cents a person per hour for parties of three or more.

Current numbers of Leaflets are free to all who wish them. Back series, complete, 50c. each; single numbers, 5c. each.

The Leaflets are published weekly or biweekly from April to June, and September to October, inclusive, by The Brooklyn Institute of Arts and Sciences, at Washington Avenue and Montgomery Street, Brooklyn, N. Y.

Telephone: 6173 Prospect.

Mail address: Brooklyn Botanic Garden, Brooklyn, N. Y.

BROOKLYN BOTANIC GARDEN

LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES V BROOKLYN, N. Y., APRIL 18, 1917. No. 3

GUIDE TO THE LABORATORY BUILDING

The aims of the Brooklyn Botanic Garden are the advancement and diffusion of a knowledge and love of plants. Consonant with these aims, the Laboratory Building was planned especially to accommodate two lines of activity—namely, botanical research and public education in botany and closely related subjects.

The building is so arranged that the research work is largely confined to the northern half, the public instruction to the southern half. The library, which ministers to both, is located in the center of the building.

The main entrance, from the Garden on the west, leads into the spacious central rotunda. Here, as throughout the building, the architectural treatment is of the Italian renaissance, the motive being similar to that not uncommonly found in churches in Lombardy—a Greek cross with a cupola at the junction of the arms. The central rotunda is recalled by two smaller rotundas at the north and south ends of the building.

The frieze is dignified with the following quotations, germane to the spirit of modern science:

1. *The essence of science is the endeavor to ascertain by the best method that which is most worth knowing.* (Anon.)
2. *The interrogation point is the key to all sciences.* (From the great French botanist, A. P. De Candolle)
3. *In natural science the principles of truth must be confirmed by observation.* (Linnaeus)
4. *Omne vivum e vivo.* This classic, but anonymous, Latin phrase, "All life from life," expresses one of the broadest and most fundamental generalizations ever arrived at by the application of the scientific method, as concisely expressed in the first three quotations.

Turning to the left, down the north corridor, one passes in order the public office, offices of the director, the curator of plants, the curator of public instruction, and a large room opening to the left (west) from the north rotunda. This last room is planned for the installation of small, temporary exhibits and teaching collections*, and will also be convenient in connection with conferences and occasional social functions. The walls are of burlap, underlaid with soft wood, instead of plaster, so that

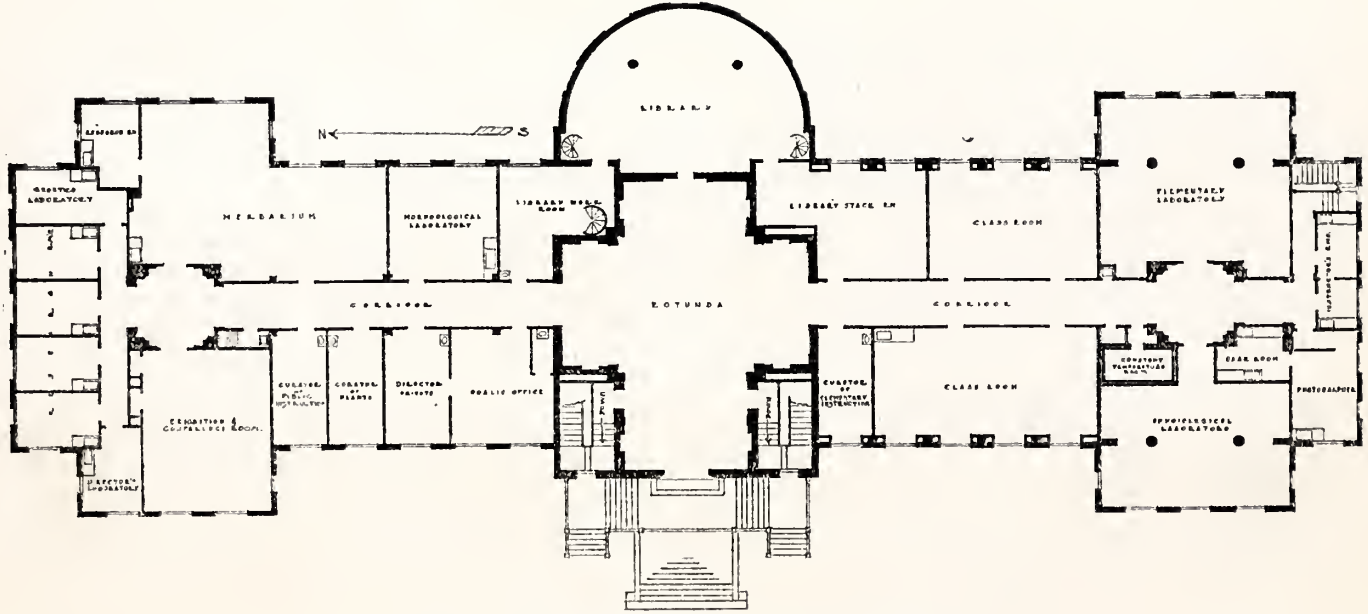


FIG. 1. Laboratory Building. Main floor plan.

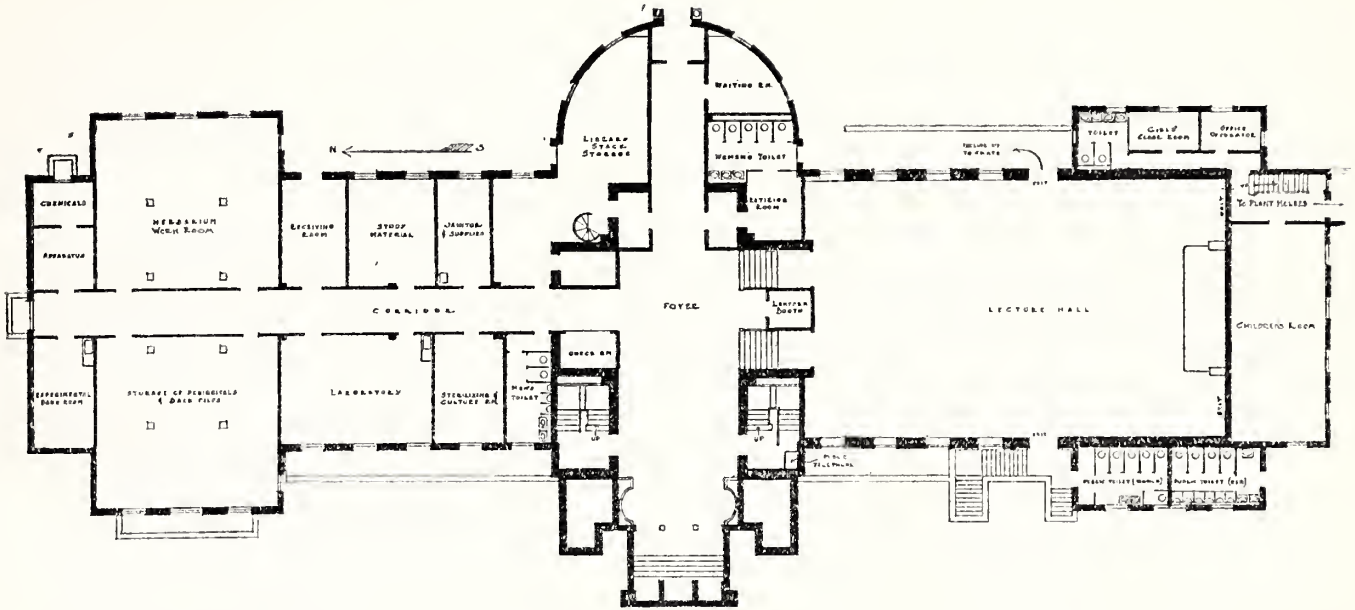


FIG. 2. Laboratory Building. Basement floor plan. South exits of lecture hall open into sub-basement, under the children's room.

herbarium sheets and other exhibits may be fastened to the wall by thumb-tacks or otherwise.

The six small rooms at the north end of this corridor are private research rooms, the north-east one being occupied as a genetics laboratory. Each of these rooms (as well as all other rooms of the building) is supplied with water, and with gas and electricity for experimental purposes, in addition to the lighting system.

The double doors on the east of the north rotunda lead into the large herbarium room, and opening from the northwest corner of this room is the private room for the curator or assistant curator. The next door south, in the corridor, also opens into the herbarium, and the second door into the morphological laboratory; the third and last door before reaching the main rotunda leads into the librarian's office and work room.

The main library room, entered from the east side of the central rotunda, contains the librarian's desk, the periodical table, the card catalog, and steel book stacks, arranged on the main floor and balcony. Opening from this room on the south is a library stack room, with the stacks here also on two levels. The total shelf capacity is about 40,000 volumes.

On either side of the south corridor is a class-room, and on the west side is also the office of the curator of elementary instruction.

Opening from the south rotunda on the east is an elementary laboratory, and, on the west, a laboratory for plant physiology.

The first door north of the rotunda, on the west, leads into a constant temperature room, with the walls constructed essentially like those of a fireless cooker.

At the south end of this floor are two research rooms, or small offices, and in the southwest corner the photographer's operating room and dark room.

The lecture hall, seating about 575, occupies the south half of the basement, while opening from the north basement corridor on the west are the men's room, the culture room (lined with tile), pathological laboratory, periodical storage room (for over copies of the periodicals published by the Garden), and experimental dark room; on the east the storage room for apparatus and chemicals, herbarium work room, receiving room, study material room, janitor's room, and library stack room. The east corridor leads from the central foyer to the main east entrance on Washington Avenue. Opening from this corridor on the south are the waiting room and the women's room.

There is an exit of three double doors leading west from the central basement foyer to the Garden.

At the extreme south end of the building, at the ground level of the Garden, are a large children's room, curator's office, and girls' coat room. A boys' coat room and three service rooms are in the sub-basement.

The laboratory building connects at the south, by glass passageway, with the greenhouses for investigation and instruction, and also with the public conservatories.

On either side of the main floor entrance from the west (Garden) side, stairs lead from the central rotunda down to the lecture hall. **There is a public telephone booth at the foot of south stairs.**

C. Stuart Gager.

*The Garden has no museum, aside from the collections of living plants.

BROOKLYN BOTANIC GARDEN

LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES V BROOKLYN, N. Y., APRIL 25, 1917. NO. 4

THE SMALL VEGETABLE GARDEN

The Site.—When selecting the position for the vegetable garden (if there is any choice), one should be chosen that is open to air and sunshine, and sheltered from north and northwest winds; at the same time bearing in mind the fact that without good soil of fair depth (eight to twelve inches) large crops cannot be expected.

The Soil.—The soil is of primary consideration in the successful cultivation of vegetables, and thorough preparation is essential for the best results.

If time and labor are available, it will pay to stir up and pulverize the ground to a depth of eighteen inches or two feet, an operation known as trenching, or double digging. It is carried out by first opening a trench at one end two feet wide and one foot deep and carrying the soil so obtained to the other end of the plot that is to be trenched. The bottom of the trench is then dug up with a spading fork and all clods thoroughly pulverized. A layer of well decayed stable manure three inches thick should then be placed in the trench. Continue the work by opening up another trench two feet wide and one foot deep, using the soil so obtained to fill up the first trench. Dig the bottom of the second trench, apply manure, and continue operations until the end of the plot is reached, when the soil taken from the first trench will be available for filling the last made trench.

If for any reason it is not possible to trench the plot, the next best thing is to cover the surface of the ground with well decayed manure three inches deep and then spade it in, burying it as deeply as possible.

In the city it is often difficult or impossible to obtain well decayed manure. In this case, if the soil is already in fair physical condition, with neither sand or clay predominating, a complete concentrated fertilizer obtainable from most seedsmen should be applied according to directions supplied with the fertilizer—usually about 25 pounds to a plot 20x40 feet. This should contain approximately nitrogen 5%, phosphoric acid 8%, potash 5%. Supposing your soil is very sandy or clayey, it will be necessary to apply vegetable matter of some kind to improve its physical condition. This can be accomplished by purchasing one of the many brands of prepared humus that are on the market and applying a layer about two inches thick, then mixing it thoroughly with the soil. Many soils, especially those in city back yards, are acid, and are benefited by the application of lime. This may be applied in the form of ground limestone, preferably in the fall, scattering it on the surface of the freshly turned soil and thoroughly raking it in. Use about 40 pounds to a plot 20x40 feet. The desirability or otherwise of liming may be determined by pressing blue litmus paper on a handful of moist soil; if the litmus turns red it indicates acidity and the need of lime.

Planting.—The seed should be sown in drills of suitable depth made with a draw hoe or the edge of a rake, first making the soil as fine as possible. A line should always be stretched as a guide when making the drills, as this insures a straight row and subsequently greater ease in cultivation. Place the seed evenly in the drills, cover with fine soil, and firm with the back of a hoe or the foot.

Cultivation.—When the young plants appear, the soil around them must be hoed or scratched in some way to break the surface crust. This allows air circulation through the soil, keeps down weeds, and provides a soil blanket, or dust mulch, which assists in the conservation of moisture. If the weather permits, the surface should be cultivated in this way every week or ten days. It is important to stir the surface of the soil as soon after a rain as it is possible to work without the earth sticking to the hoe, in order to prevent undue evaporation of water.

The Plan.—The rows, when possible, should run north and south. If this is not possible, the low growing vegetables should be placed at the south end of the plot, so that they will not be shaded by the taller growing kinds. Perennial vegetables, such as Rhubarb, Asparagus, and Artichoke, should be placed together at one end of the plot, so that they are not in the way when digging or plowing the ground for the next season's work. Crops which are to be followed by other crops later in the season should be grouped together as far as possible, as this facilitates

the work and prevents disturbance of the more permanent plantings. The accompanying plan may provide helpful suggestions. The quantities and kinds of vegetables grown must, of course, be determined by individual preference:

(North)	20 feet wide	(South)
2 ft. Corn (early)	followed by Peas	
3 ft. Corn (main crop)		
3 ft. Spinach (spring)	followed by ½ row Egg-plant and ½ row Pepper	
3 ft. Lettuce	followed by Tomato	
3 ft. Pototoes—Green Mountain		
3 ft. Potatoes—Green Mountain		
3 ft. Peas (early)	followed by Cauliflower (fall)	
3 ft. Peas (early)	followed by Cabbage (late)	
3 ft. Early Cabbage	followed by Celery	
1 ft. 6 in Bush Beans	followed by Turnips	
1 ft. 6 in. Bush Beans	followed by Beets	
1 ft. 6 in. Beets (early)	followed by Bush Beans	
1 ft. 6 in. Onion (sets)	followed by Beets	
1 ft. Carrot (early)	followed by Fall Spinach	
1 ft. Onion (main crop)		
1 ft. 6 in. Swiss Chard		
3 ft. Rhubarb 3 plants 3 ft. apart	Parsnip ½ row	Sown with Radishes
1 ft. 6 in.	Parsnip ½ row	Sown with Radishes

40 feet long

Note.—Two rows of *Spinach*, and two rows of *Lettuce* may be grown in the space to be occupied later by *Egg-plant*, *Pepper*, and *Tomato*. Similarly two rows of *Onion sets* may occupy the ground to be used later for growing *Beets*. *Lettuce* may be sown directly in the drill where the plants are to mature, or, it may be sown in a seed bed or shallow box and the seedlings transplanted to their permanent quarters when they are two or three inches high. *Cabbage* or *Cauliflower* are best sown in seed bed and transplanted later. Unless one has a greenhouse or other facilities for raising tender seedlings, it is better to obtain plants of *Tomato*, *Egg-plant*, and *Pepper* from a seedsman at planting time.

Usually there is not much room in the small garden for such crops as *Cucumber*, *Melon*, *Squash*, etc. When a rich soil, in a in a sunny position, near a fence, is available, however, they may sometimes be grown to advantage by training them on the fence, thus economizing space.

Time to Plant, Depth to Plant, Distance between the Rows and in the Rows, and Quantity of Seed required for a 100 ft. Row

Vegetables	*Time to plant*	*Depth*	*Distance between rows*	*Distance in the rows*	*Quantity*
Bean (pole)	May 20 to June 20	2 in	4 ft	in hills 4 ft. apart, about 3 seeds to a hill	1 pint
Bean (lima)	May 20 to June 20	2 in	4 ft	in hills 4 ft. apart, about 3 seeds to a hill	1 pint
Bean (dwarf)	May 10 to Aug	2 in	1 ft. 6 in	3 in	1 quart
Beet	April to Aug	1½ in	1 ft. 6 in	4 in	2 oz.
Cabbage (early)	Feb. indoors; plants set out in Mar.	3 ft	2 ft		1 oz. will produce 2000 plants
Cabbage (late)	May, indoors; plants set out in July	3 ft	2 ft		1 oz. will produce 2000 plants
Carrot	April to July	1 in	1 ft	3 in	1 oz.
Cauliflower (early)	Feb. indoors; plants set out in Mar.	3 ft	2 ft		1 oz. will produce 2000 plants
Cauliflower (late)	May, indoors; plants set out in July	3 ft	2 ft		1 oz. will produce 2000 plants
Celery	Mar. indoors; plants set out in early July.	3 ft	9 in. to 1 ft.		1 oz., about 3000 plants
Corn	May 10 to July 10	2 in	3 ft	2 ft	1 pint
Egg-plant	Mar. indoors; plants set out in late May or early June	3 ft	3 ft		1 oz. will produce 600 plants
Lettuce	April to Aug	½ in	1 ft	9 in. to 1 ft.	½ oz.
Onion (seed)	April to May	1 in	1 ft	4 in	1 oz.
Onion (sets)	Mar. 15 to May 15	2 in	1 ft	2 in	
Parsley	April	½ in	1 ft	6 to 8 in	½ oz.
Parsnip	April	1 in	1 ft. 6 in	6 in	½ oz.
Peas (dwarf)	Mar. 15 to June 15 and Aug. 1 to 20	2 in	2 to 3 ft.	2 in.	1 quart
Peas (tall)	Mar. 15 to June 15 and Aug. 1 to 20	2 in	4 to 6 ft.	3 in	1 quart
Peppers	Mar. indoors; plants set out in late May or early June		3 ft	2 ft	small package
Potatoes	April 15 to June	4 to 6 in.	3 ft	12 to 18 in	1 peck
Radish	Mar. to Sept	½ in	1 ft	2 in.	1 oz.
Spinach	Mar. and Sept.	1 in	1 ft. 6 in	4 in.	1 oz.
Swiss Chard	April	1 in	1 ft. 6 in.	6 in.	1 oz.
Tomato	Mar. indoors; plants set out in late May or early June		3 ft	3 ft	1 oz. will produce over 1000 plants
Turnip	April and Sept	½ in	1 ft. 6 in.	6 in	1 oz.

MONTAGUE FREE.

CHILDREN'S NUMBER

BROOKLYN BOTANIC GARDEN

LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES V | BROOKLYN, N. Y., MAY 2, 1917. | NO. 5

FOURTH ANNUAL GARDEN EXHIBIT FOR BROOKLYN BOYS AND GIRLS

"Let your back yard work for you!" is the cry one hears on all sides these days, and surely this year, when high prices make vegetables a luxury, this ought to be the battle cry of every boy and girl in the Borough of Brooklyn. This year the Brooklyn Botanic Garden has set aside two days, September 14 and 15, for its fourth annual exhibit for the boys and girls of Brooklyn. All exhibits, of schools as well as of individuals, must be brought to the Brooklyn Botanic Garden on the afternoon of September 13th, or by ten o'clock on the morning of the 14th. The exhibit will be judged on the afternoon of the 14th, and will then be on exhibition for the public from three to five o'clock on the afternoon of the 14th, and from ten in the morning until four in the afternoon of the 15th. The announcement of prizes will be made on the 15th. After four o'clock of this day exhibitors may remove their exhibits. Prizes will be distributed on Saturday afternoon, September 29, at three o'clock. Entry cards may be procured from your school or from the Botanic Garden. Be sure that you have not only entered your produce in the class to which it belongs, but also follow the directions given under each class, thus avoiding disappointments. For example, in Class D3 the best collection of *ten blue* asters is asked for: have *ten* asters, no more; and it is a class for *blue* asters, so send in only blue asters. A bunch of asters of different colors will not do.

To meet the needs of all exhibitors there are classes in which boys and girls may exhibit flowers, potted plants, vegetables, and wild flowers. There are also classes for schools both in suburban sections and where tenements make possible box gardens only.

Class A—**School Display**—First prize, a trophy to the school making the best display; second prize, a silver cup. For three years P. S. 152 has won first place in Class A, which means that the bronze statue of Victory is theirs. This year the Botanic Garden will offer a new trophy;—remember, any school may compete for this. Here is a chance for your school to get into the running. We want some new schools to try for the new trophy. See if this year your school cannot send in the best collection of vegetables, flowers, and plants. These may be raised either at schools or in home gardens.

Class B—**Roof Garden Display.**—If you have not a back yard, here is a chance for you to see how attractive you can make your roof. Either flowers or vegetables may be raised. The roof gardens will be visited three times during the summer. Each time your garden will be marked. The garden receiving the highest average will win first prize. The class is open to individual children, families of children, schools, and settlement houses. First and second prizes will be awarded.

Class C—**Box Display.**—This display will consist of plants and flowers in boxes and of potted plants. There are schools where it is impossible to have a school garden, and where the neighborhood is such that it is impossible to have home gardens; for such this class is added. A first prize, a trophy, will be awarded under the same conditions as stated before for Class A.

Class D—**Flowers.**—This is a class for individual competition and in which first and second prizes are offered. In this and the following classes the first prizes are silver medals; second prizes, bronze medals. Certificates of honorable mention will also be awarded. If a boy or girl enters an individual class, he must understand that these same products cannot count toward his school display. Double entries should be made in such cases. Do not forget this. If you enter ten zinnias for an individual prize and wish to add zinnias to the school display, then you must bring two bunches of zinnias, ten in each bunch. The divisions in Class D are as follows:

No. 1. Ageratum
Best 4 sprays

No. 2. Alyssum
Best plant (potted)

No. 3. Asters, blue
Best collection of 10

No. 4. Asters, pink
Best collection of 10

No. 5. Asters, white
Best collection of 10

No. 6. Asters, mixed
Best collection of 12

No. 7. Asters
Best plant (potted)

No. 8. Calendula
Best collection of 8

No. 9. Cornflower
Best collection of 12

No. 10. Dianthus
Best collection of 10

No. 11. Marigold
(Giant African)
Best collection of 12

No. 12. Marigold
(dwarf French)
Best collection of 12

No. 13. Marigold
Best plant (potted)

No. 14. Nasturtium
Best collection of 12

No. 15. Phlox
Best collection of 8

No. 16. Sunflower
Largest specimen flower

No. 17. Verbena
Best collection of 10

No. 18. Zinnia
Best collection of 10

Class E—**Vegetables.**—Surely this ought to be a popular class this year. Read over the list of vegetables in this class, consult the planting table, and plan ahead, so your vegetables will be in their prime at exhibit time. Try to send in perfect specimens. If, for example, you are exhibiting under No. 17, red tomatoes, have your eight tomatoes as near the same size as possible. Wash your vegetables carefully, so that they make an attractive appearance. First prizes in this class are silver medals; second prizes, bronze medals; third prizes, certificates of honorable mention.

No. 1. Beans, bush
Best pint, shelled

No. 2. Beans
Best quart, unshelled

No. 3. Beets
Best bunch of 6

No. 4. Carrots
Best bunch of 5

No. 5. Cabbage
Best head

No. 6. Corn
Best 6 ears

No. 7. Egg-plant
Best 2

No. 8. Kohlrabi
Best 4

No. 9. Lettuce
Best 2 heads
(roots and all)

No. 10. Onions
Best 4

No. 11. Peppers
Best 4

No. 12. Potatoes
Best 6

No. 13. Pumpkin
Best specimen

No. 14. Radish
Best 8

No. 15. Squash
Best specimen

No. 16. Tomatoes, green
Best 8

No. 17. Tomatoes, red
Best 8

No. 18. Tomatoes
Small-fruited varieties
Best 10

Class F—**Best Special Plant.**—Any plant cared for by the exhibitor may be entered. The plant may be a geranium raised from a cutting, an aster from seed, a fern from a runner—it matters not so long as the work is yours. The plant stands no chance of prize winning if it is not in good condition, clean, properly potted, and free from insect pests. First prize in this class is a silver medal; second prize, a bronze medal; third prize, certificate of honorable mention.

Class G—**Best Bunch of Flowers.**—Judged on perfection of the flowers and taste in arrangement. First prize in this class is a silver medal; second prize, a bronze medal; third prize, a certificate of honorable mention.

Class H—**Individual Garden Display.**—The greatest variety of flowers or vegetables raised by one child constitutes this display. Here is an opportunity to show some originality and taste in the way you put together and arrange your own exhibit. Let us have more exhibits in this class this year. First prize, a silver medal; second prize, a bronze medal; and third prize, certificate of honorable mention.

Class I—**Weed Display.**—This weed exhibit may be one of either fresh or pressed specimens. No exhibit can take a prize unless the specimens are carefully and correctly named. If you go away to the country in the summer you will have an especially good opportunity to make a large collection of weeds and wild flowers for the exhibit. First prize is a silver medal; second prize, a bronze medal, and certificates of honorable mention will be awarded to those taking third places.

Class J—**Wild Flowers.**—Similar to Class I. First prize, a silver medal; second prize, a bronze medal; third prize, certificates of honorable mention.

Class K—**Back Yard Gardens.**—Open to any boy or girl. If you wish to enter this class, send a postal to the Botanic Garden by June 1. The awarding of the prizes in this class, as in Class B, will be based on three inspections of your garden during the summer. First prize is a silver medal; second prize, a bronze medal; certificates of honorable mention will also be awarded.

Outdoor Planting Table

Flowers	*Time*	*Depth*	*Seeds apart*	*Thin out to*
Ageratum	May 15	Just cover	Scatter seeds	6" to 1' apart
Alyssum, sweet	May 15	Just cover	Scatter seeds	6"
Aster	May 15	Just cover	Scatter seeds	7" to 1' apart
Calendula	May 15	½ inch	Scatter seeds	1'
Castor Oil Plant	May 15	2 inches	3 inches	2 to 3 ft. apart
Cornflower	May 15	½ inch	Scatter seeds	6"
Dianthus	May 15	Just cover	Scatter seeds	6"
Marigold (tall)	May 15	½ inch	Scatter seeds	1'
Marigold (dwarf)	May 15	½ inch	Scatter seeds	3"
Morning Glory	May 15	½ inch	Scatter seeds	6"
Nasturtium (dwarf)	May 15	1 inch	3 inches	6"
Nasturtium (tall)	May 15	1 inch	3 inches	6"
Phlox (dwarf)	May 15	½ inch	Scatter seeds	6"
Sunflower	May 15	1 inch	6 inches	1'
Verbena	May 15	Just cover	Scatter seeds	1'
Zinnia	May 15	¼ inch	Scatter seeds	1'

Vegetables	*Time*	*Depth*	*Seeds apart*	*Rows apart*	*To maturity*
Beans, bush	May 1 to Aug. 1	2 in	2 in.	1½ ft	60 to 90 days
Beet	Apr. 1 to Aug. 15	2 in	¾ in.	1 ft	75 to 80 days
Carrot	April	½ to 1 in.	⅔ in.	1 ft	90 to 120 days
Kohlrabi	Apr. 1 to Aug. 1	½ in	6 in.	1 ft	65 to 35 days
Lettuce	April–August	½ in	3 in. (thin out)	1 ft	75 to 100 days
Onion	May 15	½ in	2 to 4 in.	1 in	120 to 175 days
Radish	Apr. 1 to Sept. 1	½ in	1 in.	6 in	25 to 30 days
Sweet Corn	May 15 to July 10	2 in	3 in.	4 ft	80 to 100 days
Squash, Hubbard	May 15 to June 15	2 in	5 seeds in hill	hill 5 in. apart	70 to 90 days
Tomato	Start seeds indoors in March. Set out plants May 15	½ in	Transplant to 3 ft. apart		120 to 140 days

Last year, owing to the summer epidemic, the number of exhibitors remained about the same as the year before, but there was a great improvement in the character of the exhibits and attractiveness of the display. This will be the first children's garden exhibit held in the new building of the Brooklyn Botanic Garden. There will be plenty of space this time. Let us make this exhibit worthy of its new home, so that on September 14 we may proudly announce that it is the biggest and best we have ever had.

JEAN A. CROSS,
Assistant Curator of Elementary Instruction.

BROOKLYN BOTANIC GARDEN

LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES V | BROOKLYN, N. Y., MAY 16, 1917. | NO. 6

SOME INSECT PESTS*

INTRODUCTION

The successful control of injurious insects which affect plants depends largely upon the application of preventive or remedial measures at the right time. For instance: San Jose Scale is best controlled by spraying in fall or early spring; apple trees liable to attack by Codling Moth must be sprayed as soon as the blossoms fall, when the calyx cups are in an upright position and will retain the poison; and in all cases remedial measures must be applied at the earliest possible moment before the insects have had time to become numerous and firmly intrenched. Thus, in combating Aphids on fruit trees, spraying with lime sulphur (winter strength) before leafbuds open will destroy many of their eggs, and a nicotine or soap spray when the leaves are unfolding (April 27th to May 1st) will take care of the first brood and probably prevent a serious attack later in the season. It is much easier, and better, to kill a *few* insects before they have done much damage than it is to get rid of a large number when they have probably done serious injury to the trees or plants attacked.

If it is possible to control the pests by spraying, it is necessary that the right kind of spray be used, or, if spraying is of no avail, one must know what measures to take to prevent damage. In the first place, it is important to know whether we are dealing with "biting" or "sucking" insects. The former group—those which bite or chew their food—can usually be dealt with by poisoning their food with an arsenical spray of some kind, arsenate of lead or Paris green being most commonly used. Obviously this kind of treatment can only be successful when the insects feed openly. If they feed in such a manner that it is not possible to poison their food, other methods must be adopted. These may take the form of some change in horticultural practice, such as

*The Botanic Garden is indebted, through Dr. W. E. Britton, to the Connecticut Agricultural Station, for the cuts illustrating this LEAFLET.

early fall digging or plowing, or the substitution of salty commercial fertilizers like kainit and nitrate of soda for barnyard and stable manure; or, some measure that will prevent the laying of eggs must be adopted. It is impossible, for instance, to poison the food of the borers—those pernicious insects which eat their way into the wood or bark of many of our fruit, ornamental, and forest trees; frequently so injuring the tree that it dies.

Our efforts in such cases as these must be largely preventive, as, when these insects have once obtained entrance to a tree, the only thing to do is either to cut them out with a knife, the remedy often being worse than the disease; probe for them with a flexible wire, or inject carbon bisulphide, potassium cyanide, or some such poison in their borings. All of these measures are tedious and at the best not entirely successful. The borers are the larvae of beetles, butterflies, or moths, and if we can prevent the adult insect from ovipositing on the trunks of the trees we can save the trees from being damaged. Thus the round-headed apple-borer and the peach-borer may be controlled by covering the trunks of the trees for two feet above the surface of the ground with fine-meshed wire mosquito netting, keeping the netting about one inch from the trunk of the tree, filling in the space at the top of the cylinder with cotton, and hilling up with soil at the base to prevent the ingress of the adults. Newspapers will serve the same purpose, but possess the disadvantage of being unsightly and of having to be renewed each year. It is advisable also to spray the trunk up to five or six feet with lime, to which salt has been added to improve its adhesive qualities, or with bordeaux mixture. Cleanliness, in the way of keeping garden or orchard clear of dead and dying material, and rubbish of any kind, is most important in controlling borers or any kind of insect and fungous pest.

Cut-worms, the bane of most amateur growers and many professionals, are difficult to control by spraying, and many varied methods must be adopted to get the better of this pest in gardens where it is abundant. Some plants, such as cabbages and tomatoes, may be protected by wrapping the stems in stout paper at planting time. They may be trapped by laying near the plants shingles or pieces of board under which the cut-worms will congregate, or, if one has only a few plants to take care of, the pests may be sought for just under the surface of the ground near the plants which are being attacked. One of the most effective ways to combat cut-worms is by means of poisoned bran, scattered liberally about the plants subject to attack.

Sucking insects are those which obtain their food by inserting their proboscis into some part of the plant and sucking the sap. Among the most important of the sucking insects are the

Aphids, or Plant Lice, and the various scale insects. The principal control measures to be adopted are the spraying of the insects with a solution or dusting them with a powder, so as to actually hit the insect, the object being to kill by blocking its breathing pores. Sprays that come in this category are soap solutions, kerosene emulsion, and nicotine; powders are tobacco dust, hellebore, and pyrethrum powder. When aphids attack the roots of plants as does the woolly apple aphis, recourse must be had to removing the soil around the tree, partially exposing the roots, and putting in about three inches of coarsely ground tobacco stems. This is a cheap insecticide, because the tobacco also acts as a fertilizer and is almost worth the money paid for it for this purpose alone. It is also good horticultural practice to make use of commercial fertilizers, such as kainit and nitrate of soda, when root lice are present in the ground.

SOME COMMON INSECT PESTS

The following are among the commoner insect pests likely to occur in the vicinity of Brooklyn:

Mealy Bugs. It is the female of this insect that is injurious to plant life, the male being unprovided with mouth parts. The female is covered with a white, waxy farina, from which the insect obtains its name. It is, in the Northern States, only troublesome out-of-doors on plants used for bedding, such as Coleus and Salvia. Spraying with soap solution or kerosene emulsion, which must actually be brought in contact with the pest, is usually effective.

Greenhouse Mite: Red Spider. Although this is primarily a greenhouse pest in this latitude, it, or a closely allied species, does considerable damage out-of-doors, especially upon conifers. It attacks plants by sucking their juices, and the leaves quickly turn to a brownish-yellow color. The insects are barely visible to the naked eye, and they usually work on the under side of the leaves, spinning a web behind which they work. Their color is variable, and may be red, orange, yellow, green, or blackish. Frequent spraying on the under side of the leaves with water, applied as a stream of considerable force, is usually the best way to control them.

White Fly. This is a sucking insect which frequently attacks outdoor plants, although it is a tropical insect and unable to survive our winters. The adults have pure white wings and yellow bodies and in appearance resemble a miniature moth. Both nymphs and adults injure the plants by sucking sap from the under surfaces of leaves, and they often injure the plant attacked still more by depositing upon the leaves a substance similar to the honey dew secreted by Aphids. This sugary substance serves

as a nidus for a black fungus, which greatly disfigures the leaves and renders them unhealthy because it blocks up the stomata, or "breathing pores", of the plant. The insects are easily controlled in the greenhouse by fumigation with hydrocyanic acid gas, but out-of-doors they are more difficult to manage, because the adults are very active and fly away as soon as spraying commences, only to return again when the coast is clear. Persistent spraying with any of the contact sprays—soap, nicotine, or kerosene emulsion—will eventually exterminate them. Care should be taken when applying the spray to reach the under side of the leaves.

Oyster-Shell Scale. (*Fig. 1.*) These scales obtain their name from the fact that they resemble an oyster shell in outline. They are a serious pest on apple, willow, lilac, and other trees and shrubs. The infested plants should be sprayed about the second week in June when the young scales are emerging from the protecting scales of the parent insects. Use kerosene emulsion.

San Jose Scale. (*Fig. 2.*) This is another scale insect, more rounded in outline than the preceding, that is best combated by winter treatment. It infests practically all fruit trees and is frequently found on roses. It should be sprayed in fall, as soon as the leaves are off the trees, with commercial lime-sulphur (winter strength) or with a miscible oil, such as scalecide, using one part to fifteen parts water. It is advisable to give another spraying in the spring before the buds open, if the trees are badly infested.

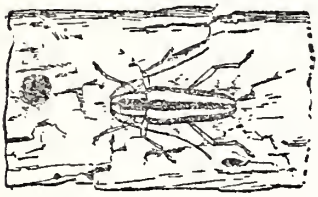
Aphids: Plant Lice. (*Fig 3.*) Many different species of aphis infest plants, and there is scarcely any kind of plant that is immune from their attack. When they infest fruit trees, or arborescent and shrubby plants generally, their numbers may be materially reduced by spraying with lime-sulphur (winter strength) before the buds open in spring. This treatment destroys their eggs. Later on in the season they may be controlled by spraying with nicotine or soap solution. A typical aphis is illustrated at *Fig. 3.*

All of the above are sucking forms, and to do any good the

spray must actually come into contact with the insects, preferably with some force. All sprayings for sucking insects must be thorough in character, so as to wet them completely with the spray used.

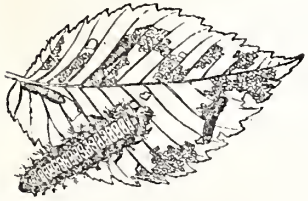
Rose-chafer. These insects, belonging to the beetle group, appear about the time that roses and grapevines are in bloom and do an enormous amount of damage by eating the flowers. No satisfactory treatment has yet been discovered. Picking them off by hand and dropping them into a can of kerosene, or otherwise destroying them, is as good a practice as any. Spraying the plants attacked with sweetened lead arsenate sometimes helps to reduce their numbers.

Round-headed Borer: Flat-headed Borer. (*Fig. 4.*) Attack fruit trees, being partial to apples. They are the larvae of beetles, and burrow into the wood at the base of the trunk. Close watch should be kept on fruit trees, and when borers are found to be present they should be dug out or killed by inserting a wire. Carbon bisulphide may be injected into the hole and the opening then plugged with with soap or putty. Preventive treatment as described in the introduction should also be used.



Colorado Beetle (*Fig. 5.*) Both the adults and larvae do much damage to potatoes, tobacco, petunias, and other solanaceous plants by eating the leaves. Affected plants should be sprayed with lead arsenate or dusted with Paris green, renewing the poison at intervals until the pests have all been destroyed.

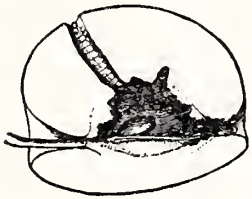
Elm Leaf Beetle. (*Fig. 6.*) The adult attacks the leaves of elm trees in spring, causing "shot holes." The larvae appear a little later and eat the under side of the leaves. Spraying with lead arsenate should commence as soon as the beetles commence feeding, the object being to kill as many adults as possible and prevent the laying of eggs. When the larvae begin to hatch, another application should be given, taking care this time to get the poison on the under side



of the leaves. A second or third spraying may be necessary, in order to properly protect the trees.

Tent Caterpillars. (*Fig 7.*) Are very common in neglected orchards. The eggs hatch out in spring, and the young caterpillars at once begin to spin a tent-shaped web in which they form a community. The egg masses should be cut and destroyed in winter; the tents or nests may be cut down and burned when found in spring, or the vicinity of the nest may be sprayed with lead arsenate.

Cut-Worms. (*Fig. 8.*) These are the larvae of various specimens of Moth. They attack all kinds of plants, being particularly partial to young bean plants. Remedial measures are described in the introduction.



Codling Moth (*Fig 9.*) The cause of wormy apples. The eggs are laid singly in the center of the blossom. The eggs hatch in a few days, and the young caterpillars, after feeding on the outside a few days, burrow into the fruit. The trees should be sprayed with lead arsenate just as soon as the blossoms fall, the spraying to be repeated three or four weeks later.

Ants. While ants do not do much actual damage in a garden, yet they are undesirable because of their propensity for transferring plant lice from plant to plant. Also they do some damage when their nests are constructed around the roots of plants. They may be destroyed by pouring carbon disulphide into the nest, using from one to three ounces, depending upon the size of the nest. Care must be taken when using carbon disulphide, as it is extremely inflammable and dangerous to use if fire of any kind is near.

Beneficial Insects

Because we have so many injurious insects which attack our crops and give us sleepless nights, it is pleasing to be able to chronicle the fact that there are some insects that are distinctly beneficial, because of their habits of feeding upon injurious insects. Mention must be made of the lace-wing fly, the larvae of which (aphis lions) attack and destroy aphids and other soft-bodied insects which affect plants. The adult lace-wing fly is usually a beautiful insect with bright golden eyes. They emit an offensive odor when handled.

The well-known and easily recognized lady-bugs are also generally beneficial, as the larvae feed upon plant lice and scale insects. The members of one genus belonging to this family, however, are vegetarians, and eat the leaves of melons, cucumbers, and allied plants. They can easily be controlled by means of one of the arsenical sprays.

The Tachina flies are parasites upon caterpillars of various kinds, cut-worms being especially singled out for attack. Frequently cut-worms can be found with small white eggs attached to their backs near to the head. These are the eggs of the Tachina flies, and cut-worms so infested should be allowed to go free.

Among other beneficial insects are the Calosoma beetles, which attack the larvae of the Gypsy moth; Wheel bugs, which attack various insects, including the larvae of the elm leaf beetle; Ichneumon flies, parasitic upon some borers and the larvae of various butterflies; and the digger-wasps, which frequently lay their eggs on the bodies of "white grubs."

Efforts should be made to get acquainted with these beneficial insects, so that they may not be killed off with the injurious ones, as they assist materially in keeping down our insect enemies.

Spraying Methods

When applying contact sprays it is most important to spray thoroughly, taking care to wet every insect, if possible. To do this properly a spraying machine working under considerable pressure is desirable.

The stomach poisons should be applied in the form of a mist-like spray, just sufficient to wet the leaves, so that when the moisture evaporates a film of poison is left upon the leaf. It is a mistake when applying sprays of this kind to put on so much liquid that it drips from the leaves—it is a waste of insecticide and is not so efficient.

For medium-sized gardens a compressed air sprayer, holding about three gallons of liquid, is about the best instrument to use. If trees have to be sprayed, extension pipes should be obtained in order that the top of the tree may be reached.

In very small gardens the atomizers holding about one quart are desirable.

To distribute powder insecticides, bellows of various kinds and prices can be obtained from most florists, or recourse may be had to a cheesecloth bag, from which the powder may be shaken on to the plant.

Spray Formulas

LEAD ARSENATE

(Paste) 3 lbs., or
(Dry) 1½ lbs.
50 gals. water
} Very poisonous. Do not spray fruits or vegetables that are shortly to be eaten.

PARIS GREEN

1 lb. Paris Green
3 lbs. lime
100 gals. water
} If used as a powder it can be diluted with about 25 times its bulk of cheap flour. Very poisonous. (See lead arsenate.)

NICOTINE SOLUTION

½ pint Nicotine
50 gals. water
} Two lbs. of soap should be added to each 50 gals. to assist in spreading the mixture.

COMMERCIAL LIME-SULPHUR

Winter Spray	*Summer Spray*
1 part lime and sulphur	1¼ to 1½ parts lime and sulphur
9 parts water	45 to 50 parts water

COMMON SOAP

1 lb. of soap
8 gals. water

POISONED BRAN MASH

25 lbs. wheat bran
1 lb. white arsenic or powdered lead arsenate
2 qts. cheap molasses

} Very poisonous. Do not use in positions accessible to children or animals.

KEROSENE EMULSION

2 gals. kerosene
½ lb. common soap
1 gal. water

} Boil the water and dissolve in it the soap; add the kerosene and churn violently until an emulsion is formed.

POTASSIUM SULPHIDE

3 oz. Potassium Sulphide (Liver of Sulphur)
10 gals. water

MONTAGUE FREE.

Use 1 part kerosene emulsion to 10 of water

NOTICES

The Garden is open free to the public daily, from 8 a. m. until sunset; on Sundays and holidays at 10 a. m. The Laboratory Building, containing the library, herbarium, and offices, is open daily, from 9 a. m. until 5 p. m. The Conservatories are open April 1–October 1, 10 a. m.–4:30 p. m.; October 1–April 1, 10 a. m.–4 p. m.

The Garden may be reached by Flatbush Ave. trolley to Malbone St.; Franklin Ave., Lorimer St., and Tompkins Ave. trolleys to Washington Ave.; St. John's Place and Rogers Ave. trolleys to Sterling Place; Vanderbilt Ave., Sixteenth Ave., Union St., Greenpoint, and Smith St. trolleys to Prospect Park Plaza and Union St., and Brighton Beach elevated to Consumers' Park Station. (The elevated trains stop only when the conductor is notified in advance.)

A docent will meet parties by appointment and conduct them through the Garden. This service is free to members of the Botanic Garden and to teachers with classes; to others there is a nominal charge of 25 cents an hour for parties of less than three, and 10 cents a person per hour for parties of three or more.

Current numbers of LEAFLETS are free to all who wish them. Back series, complete, 50c. each; single numbers, 5c. each.

The LEAFLETS are published weekly or biweekly from April to June, and September to October, inclusive, by The Brooklyn Institute of Arts and Sciences, at Washington Avenue and Montgomery Street, Brooklyn, N. Y.

Telephone: 6173 Prospect.

Mail address: Brooklyn Botanic Garden, Brooklyn, N. Y.

BROOKLYN BOTANIC GARDEN

LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES V | BROOKLYN, N. Y., MAY 31, 1917. | NO. 7

THE WILD FLOWER GARDEN IN JUNE

During the month of June numerous plants come into flower in the local flora section of the Botanic Garden. In this LEAFLET are mentioned, first, some plants along the path on the border mound, second, some of those in the wild flower beds, and last a few shrubs. On account of the lateness of the season, many May flowers may be expected to bloom during the first part of June.

Along the path the earliest flowers are now passing into fruit. Of the lily family the wild lily of the valley and the false Solomon's Seal have berries brownish blotched with red, or later often all red. The twisted-stalk has red berries and the somewhat similar bellwort bears three-cornered capsules; the trillium has an erect red capsule. In the true Solomon's Seal blue berries hang along the stem; while in Clintonia a few large blue fruits grow erect on a central stem. None of these berries is edible. The Indian Cucumber-root with whorled leaves is still in flower.

The plants of the buttercup family, whose flowers were so noticeable during May, form mostly inconspicuous fruits. The baneberries are an exception, one species having a white and black berry with a thick red pedicel, another a red berry; both are poisonous.

The bunchberry or dwarf cornel, *Cornus canadensis*, is now coming into flower. Its structure is similar to that of the tree flowering dogwood, *Cornus florida;* in both, large white bracts, sometimes mistaken for petals, surround a group of small flowers. Several orchids are in bloom: a yellow moccasin flower or lady's slipper, rattlesnake plantain with spotted leaves and ladies' tresses with spirally arranged flowers. A little farther on are plants of the geranium family, the wild cranesbill and the smaller Herb Robert, also found in Europe. Wintergreen, shinleaf and pipsissewa, low shrubs of the heath family, grow by the path.

After the coming of dense leaves in the woods, flowers are found mostly in the open places, and in the local flora valley below many plants are now in bloom. Near the bog are four families of monocotyledons: lily, grass, sedge, and iris families.

The grasses have round, hollow stems; the sedges, solid stems, usually triangular. In the grasses, not in the sedges, the lower part of the leaf clasping the stem is slit. The genus *Carex* of the sedges has nearly a hundred species on Long Island, many more than any other genus of plants.

The iris family is readily known by the equitant leaves. Flowers may be seen of a native iris, or blue-flag, and of a yellow species naturalized from Europe. The little blue-eyed grasses may be seen to be like iris in the flower and in the leaves.

The buckwheat family includes several common weeds: the large docks, of which there are several species; the ladies' thumb, tear-thumb, field-sorrel, and climbing knotwood. The last is sometimes taken for a morning-glory, but may be recognized by the family mark: sheaths clasping above swollen joints of the stem.

In the pink family also are several common weeds with small white star-like flowers and opposite leaves. Here belong chickweed, the fire pink, bladder campion, and soapwort.

The orpine family also has star-like flowers; the leaves are fleshy. The yellow mossy stonecrop and the large purple garden orpine are both naturalized from Europe. In the same bed is a prickly pear, the only representative here of the great western cactus family.

In the buttercup family may be seen the common tall buttercup of the meadows, *Ranunculus acris*, and the bulbous buttercup, *Ranunculus bulbosus*, lower, with somewhat different leaves and growing from a bulb-like base; both are naturalized from Europe. The meadow-rues are mostly dioecious plants; staminate and pistillate forms may be seen of the early meadow-rue, and staminate ones of the later tall meadow-rue. The purple European columbine is a garden escape. The plants of this family have the parts attached to an elongated receptacle, apparently a more primitive arrangement than that illustrated by the rose family near by. In the latter the receptacle is flattened or cup-shaped, and the stamens and petals grow from the edge, a form better adapted to insect pollination. Here bloom cinquefoil, strawberry, agrimony, and others.

The great pea family also has a flattened receptacle; but the stamens are often united and the flowers have a distinct form, papilionaceous (butterfly-shaped), like the pea. The small flowers of the clovers are grouped together, each pea-shaped. The white clover, widely distributed, is the shamrock of Ireland. The sweet

clovers have flowers in racemes; a white and a yellow form are common. Other plants here are bird-foot clover, perennial pea, and wild indigo.

The spurge family has small flowers and a milky juice. Here may be seen the naturalized cypress spurge, common along roadsides, and the American flowering spurge, milk purslane, and ipecac. In this family also belongs the Brazilian tree (*Hevea brasiliensis*) which is now the principal source of rubber.

The plants in the beds on the east side of the local flora valley are mostly gamopetalous—that is, the petals are united more or less as in the morning-glory.

The mint family is characterized by a square stem and opposite leaves; nearly all the plants have a characteristic minty odor. The ground-ivy or gill-over-the-ground and the self-heal or heal-all are common everywhere. The true mints (*Mentha*) are mostly naturalized from Europe. Other plants here are catnip, sage, dead-nettles, and bugle-weed.

Below the mints the beds are occupied by the great composite family, beginning with goldenrods and asters. These plants for the most part bloom in the late summer.

Among the shrubs in bloom now, those of the heath and honeysuckle families are conspicuous. Mountain laurel about the middle of the month forms a mass of flowers below the bog. When touched, the stamens of this flower are released and throw out pollen. The lower sheep laurel or lambkill has smaller flowers on the middle of the stem. The great laurel, *Rhododendron maximum*, flowers later in the month in the upper end of the meadow. Several blueberries and the common huckleberry are in bloom near the bog. The early low blueberry, *Vaccinium pennsylvanicum*, is the first to flower; a little later comes *Vaccinium vacillans*, and last the high-bush blueberry, *Vaccinium corymbosum*, growing usually in swamps. The huckleberries are distinguished by the reddish flowers and the hard nutlets of the fruit.

The honeysuckle family includes the honeysuckles, the viburnums, and the elders. These plants have opposite leaves, and the ovary is inferior—that is, the fruit develops below the flower. The blackberried elder is one of the last of the native shrubs to bloom. The most common viburnums on Long Island are the low maple-leaved viburnum (*Viburnum acerifolium*), the arrow-wood (*V. dentatum*), with toothed leaves, and the mayberry (*V. Lentago*), with finely serrate leaves. The snowberry and the bush honeysuckles (*Diervilla*) also flower during June. Many other plants of this family may be seen in the main part of the garden.

ALFRED GUNDERSEN.

A NEW TROPHY NEEDED

In connection with the Botanic Garden's annual children's horticultural exhibit, held each September, it has been the custom to award a trophy to the school whose exhibit wins first prize. This trophy may be retained by the school for only one year, until it has been won for the third time; it then becomes the permanent property of the school. Our first trophy, a bronze statue of Victory (illustrated in the Botanic Garden *Record* for October, 1914, p. 106, and April, 1916, p. 62), was won for the third time, at the 1916 exhibit, by Public School No. 152; it thus becomes the permanent possession of that school, and a new trophy must be provided.

An excellent opportunity is hereby afforded for any individual or organization to provide the second trophy. The first one was valued at about $50. The children's horticultural exhibit, with attendant awards, has been a means of greatly increasing the interest of schools and school children in the study of plant life and gardening, and the exhibits have improved in quality as well as in size each successive year.

The director of the Garden will be glad to give further information on the subject to any one interested.

C. S. G.

NOTICES

The Garden is open free to the public daily, from 8 a. m. until sunset; on Sundays and holidays at 10 a. m. The Laboratory Building, containing the library, herbarium, and offices, is open daily, from 9 a. m. until 5 p. m. The Conservatories are open April 1–October 1, 10 a. m.–4:30 p. m.; October 1–April 1, 10 a. m.–4 p. m.

The Garden may be reached by Flatbush Ave. trolley to Malbone St.; Franklin Ave., Lorimer St., and Tompkins Ave. trolleys to Washington Ave.; St. John's Place and Rogers Ave. trolleys to Sterling Place; Vanderbilt Ave., Sixteenth Ave., Union St., Greenpoint, and Smith St. trolleys to Prospect Park Plaza and Union St., and Brighton Beach elevated to Consumers' Park Station. (The elevated trains stop only when the conductor is notified in advance.)

A docent will meet parties by appointment and conduct them through the Garden. This service is free to members of the Botanic Garden and to teachers with classes; to others there is a nominal charge of 25 cents an hour for parties of less than three, and 10 cents a person per hour for parties of three or more.

Current numbers of LEAFLETS are free to all who wish them. Back series, complete, 50c. each; single numbers, 5c. each.

The LEAFLETS are published weekly or biweekly from April to June, and September to October, inclusive, by The Brooklyn Institute of Arts and Sciences, at Washington Avenue and Montgomery Street, Brooklyn, N. Y.

Telephone: 6173 Prospect.

Mail address: Brooklyn Botanic Garden, Brooklyn, N. Y

BROOKLYN BOTANIC GARDEN

LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES V BROOKLYN, N. Y., JUNE 13, 1917. No. 8

THE STORAGE OF VEGETABLES

Successful storage of vegetables depends in a large measure on the proper harvesting and handling of the crops. Vegetables that are bruised or broken in any way should not be stored as decay is almost certain to set in which may spread to the rest of the produce. Potatoes which are diseased (usually shown by shallow, dark-colored depressions) should be used immediately as the disease will continue to increase in storage and render the whole potato unfit for use. Great care should be taken in handling beets to avoid cutting or bruising the roots, or bleeding will ensue which will result in loss of color when they are cooked.

A frost proof, well ventilated cellar, in which a uniform temperature, not much over 40° Fahr., can be maintained, forms an ideal storage place for the majority of root crops, and some of the stem vegetables. In cases where there is a furnace in the cellar producing a temperature that is too high, a part of the cellar may be partitioned off, preferably in a position where ventilation may be secured. Many vegetables may be cared for successfully in the garden by burying them in trenches and covering them with some non-conducting material such as straw. The disadvantage of this method is that in times of severe frost it is impossible to get the vegetables just when they are required for use. In no case should an attempt be made to store vegetables thus in the open unless the sub-soil is well drained and entirely free from stagnant water. Another important point is this connection is to avoid putting the whole of the covering on at one operation as there is danger of the mass of vegetables heating and becoming spoiled. The covering should be light at first and gradually increased as really severe weather sets in.

"ROOT" CROPS

Artichoke (Jerusalem).—The tubers are perfectly hardy and may be left in the ground all winter, digging them as required when

the state of the ground permits. In sections where the soil freezes solid, a sufficient quantity should be dug and stored in sand or earth in the cellar.

Beet.—Should be dug after the first frost, being careful not to injure them in any way. Cut off the leaves about an inch from the top of the root and place them in boxes in cool cellar placing sand over and between the roots to prevent shrivelling.

Carrot, Celeriac, Horseradish, Radish (large winter kinds) and **Salsify** may be stored in sand or earth in the same way as Beets.

Parsnip is hardy and the flavor is improved by freezing. A few roots may be dug up and placed in sand in the cellar for use when the frost makes it impossible to dig roots in the garden. The same remarks apply also to Salsify and Horseradish.

The **Potato** is really a stem vegetable. It should be dug on a dry day as soon as the tops have died down. Any further drying that may be necessary should be done in the absence of light to prevent greening. When dry they should be placed in boxes or barrels in a cool frost-proof cellar, first rejecting, or laying aside for eating, diseased and injured tubers.

Potato (Sweet).—These require a warm, dry room. If they are packed in sand it will prevent shrivelling.

Rutabaga and **Turnip** should be harvested before severe freezing. They can be stored in the same way as potatoes; or, a trench may be dug in the garden and the roots placed in this, covering them with a few inches of soil, then some straw, increasing the covering as the weather grows in severity.

LEAF AND STEM CROPS

Cabbage.—There are many ways of carrying cabbage over the winter. If a cool cellar is available they may be dug up with some soil attached to the roots and packed close together on the floor. Another method is to dig a trench in the garden about a foot deep, and wide enough to accomodate two rows of cabbages. Place them heads down and cover with a few inches of earth. After the first severe frost they should receive a covering of about a foot of straw, salt hay or similar non-conducting material, the whole being kept in place with a further layer of soil.

Cauliflower may be kept for a limited period by digging them with roots attached and suspending them head down in a cool cellar. This to prevent any water from lodging at the bases of the leaves, which would cause them to rot.

Celery is another crop the flavor of which is improved by freezing. After the first frost a portion of the crop should be dug up

with roots attached and paeked closely together in rather deep boxes and placed in a cool eellar. The rest of the crop can be dug and plaeed as closely together as possible in a trench in the garden. The earth should be level with the tops of the plants. Be carefnl not to allow any soil to get into the heart of the celery. Cover the whole with boards to shed rain and in very severe weather with a layer of straw.

Kale is hardy and can stay in the beds or rows where they were grown. The leaves will remain green all winter. Some covering sueh as straw or pine boughs is desirable in very cold weather.

Onion.—Should be pulled up in dry weather and left on the surfaee of the ground for a day or two so that they may be dried thoroughly before they are brought in. They are best stored in a cool, well ventilated room in sueh a way that the air has free aeeess to them. If the autumn is very wet it is sometimes neeessary to go over the onion row a week or two before it is proposed to harvest them and perform the operation known as "wringing their necks" or "breaking". This eonsists of bending the tops at the "neck" of the onion so that they lie flat on the ground. It results in checking the growth and ensures better ripening.

Leek is hardy and may be left out and dug as required. A portion of the crop should be brought inside and stored in sand in a cool place so as to be available during severe weather.

Parsley.—A few roots may be dug up, potted, and kept in a sunny window. Treated in this way it should provide leaves for garnishing all through the winter.

Sage, Mint and **Thyme.**—These and other herbs may be cut as soon as they have perfected their growth, dried in the sun, placed in paper bags to preserve from dust, and kept in a dry room.

SEEDS AND FRUITS

Beans of the "Navy" or Lima type should be allowed to stay on the plants until ripe—as shown by the yellowing or browning of the pods—and then gathered and thoroughly dried in the sun before bringing indoors. They may be shelled or thrashed at any convenient time.

Squash and **Pumpkin** can be kept for a considerable time, if handled carefully at the time of harvesting so as to avoid bruising, and stored in a warm, dry place. It is a good practice to turn them over a week or two before harvesting so that the portion that has been lying on the earth may have the benefit of sun and air.

MONTAGUE FREE

PLANTS NOW IN BLOOM

In both the synoptic collection and Japanese Garden the different species of *Iris* are now at their best, and in the beds of the Buttercup family the columbines will be in full flower about the time this LEAFLET is issued. In the wild flower garden the flame azalea (*Rhododendron calendulaceum*) is in full flower, and along the shaded path are good masses of the water-leaf *Hydrophyllum virginianum*. Near this are a few flowers of the shy *Orchis spectabilis*, one of the most difficult of our native orchids to grow. Throughout the grounds, in the border planting, the different varieties of wiegela, pink and white, are just now very showy. Curiously enough, the mountain laurel, usually so splendid about this season, has practically no flowers this year.

N. T.

NOTICES

The Garden is open free to the public daily, from 8 a. m. until sunset; on Sundays and holidays at 10 a. m. The Laboratory Building, containing the library, herbarium, and offices, is open daily, from 9 a. m. until 5 p. m. The Conservatories are open April 1–October 1, 10 a. m.–4:30 p. m.; October 1–April 1, 10 a. m.–4 p. m.

The Garden may be reached by Flatbush Ave. trolley to Malbone St.; Franklin Ave., Lorimer St., and Tompkins Ave. trolleys to Washington Ave.; St. John's Place and Rogers Ave. trolleys to Sterling Place; Vanderbilt Ave., Sixteenth Ave., Union St., Greenpoint, and Smith St. trolleys to Prospect Park Plaza and Union St., and Brighton Beach elevated to Consumers' Park Station. (The elevated trains stop only when the conductor is notified in advance.)

A docent will meet parties by appointment and conduct them through the Garden. This service is free to members of the Botanic Garden and to teachers with classes; to others there is a nominal charge of 25 cents an hour for parties of less than three, and 10 cents a person per hour for parties of three or more.

Current numbers of LEAFLETS are free to all who wish them. Back series, complete, 50c. each; single numbers, 5c. each.

The LEAFLETS are published weekly or biweekly from April to June, and September to October, inclusive, by The Brooklyn Institute of Arts and Sciences, at Washington Avenue and Montgomery Street, Brooklyn, N. Y.

Telephone: 6173 Prospect.

Mail address: Brooklyn Botanic Garden, Brooklyn, N. Y.

BROOKLYN BOTANIC GARDEN

LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES V BROOKLYN, N. Y., JUNE 27, 1917. No. 9

THE ONE-PERIOD COLD-PACK METHOD OF CANNING*

Can surplus food. But use jars wisely; do not can anything that can be kept just as well dried or preserved in other ways. Further, in canning, concentrate the products so that each jar holds as much food and as little water as possible.

1. The Cooker.—For the "hot-water bath" cooker, use a wash-boiler or vessel or pail, fitted with a false bottom of coarse wire or wood lattice. Glass vessels should be up about 1 inch from the bottom. Steam-pressure cookers shorten considerably the time of canning but may be difficult to obtain as well as expensive.

Fill the cooker with clean water, so that the boiling water will cover the tops of the jars or cans. (If the "Economy" or similar type of jar is used, fill the boiler only to the necks of the jars.)

Begin heating the water so that it will be boiling violently by the time the containers are packed.

2. Jars or containers.—Glass-topped jars, closed with a spring, are preferable to the old-fashioned screw-topped kind. Any type of glass jar may, however, be made to serve. Tin cans are not so desirable for ordinary household use, as tin is more or less soluble and, further it requires soldering.

Vegetables, meats and fish require hermetically sealed containers. Fruits, such as jams, jellies and preserves, which are put up with heavy sirups, can, on the other hand, be kept in wide mouthed bottles or glasses under cork and paraffine seal.

Clean the jars or cans thoroughly and scald just before filling. Use *new* (*never* old) rubber rings and scald just before putting on jars.

3. Start with clean hands, clean utensils, and clean, sound, fresh products. Bacteria and the spores of molds are practically everywhere; on the hands and clothing, in the dust of the kitchen, etc. The process of canning is designed to kill them.

4. Throw out all unsound or overripe fruits or vegetables. Wash thoroughly. If possible use only fruits and vegetables

*Adapted largely from United States Department of Agriculture sources, especially from "Weekly News Letter", Vol. 4, p. 6, and Farmers' Bulletin 839, June, 1917.

picked the same day, and never can peas or corn which have been picked more than 5 hours.

5. Scald or blanch by plunging a wire basket or cheesecloth bag containing the vegetables or fruits (berries should not be blanched) into clean boiling water. Keep boiling for the time specified. Remove and plunge quickly into cold water, the colder the better. Take them out *immediately* and let drain. *Do not let them soak in the cold water.*

Blanching or scalding helps in sterilization. Many bacteria and spores of molds will undoubtedly be killed by the alternating hot and cold water. The process also hardens the pulp, making it easier to remove the skins and to handle the product.

6. *Do not let the blanched vegetables or fruits remain out of the jars a moment longer than is necessary.*

Remove skins when required; cut into proper size and pack carefully yet closely into the clean, freshly scalded jars, being careful not to bruise or mash soft products.

7. In the case of fruit, fill the jars with boiling hot sirup. This may be made by boiling in a sauce pan sugar and water at the rate of 1½ pints of sugar to 1 pint of water: just bring to a boil for apples; boil about 3 minutes for pears, peaches and wild fruits; 8 minutes for raspberries, strawberries, blackberries and cherries; 10-12 minutes for preserves or anything which must be very sweet. The sirup may be kept hot by keeping it in closed containers in a vessel of hot water.

Or, fruits may be canned without the use of sugar simply by adding boiling hot water instead of the hot sirup.

In the case of vegetables, fill the containers with boiling hot water, and also add a little salt (about 1 teaspoonful to each quart jar.)

8. Place scalded rubber rings on the glass jars and close lids tight. (Some prefer, when the water in the boiler comes only to the necks of the jars, to clamp or screw lids on *loosely*, in order to allow for further expansion as well as for steam to enter. This is a necessary procedure with some types of jars, such as "Economy"). Seal the tin cans completely. Watch for leaks. As the preliminary treatment has taken care of expansion, it is not necessary to exhaust the tins.

9. Put jars or cans as soon as possible into the boiling water (a pair of jar-tongs are useful for this purpose; or the false bottom can be readily fitted with strong cord or wire for lifting entire) in the wash boiler or canning device. Do not pack the glass jars too closely. Cover the cooker with a cloth, then the lid, to conserve the heat and steam, and proceed for the time specified in the table, counting from the time the water begins to boil again or the gauge on the steam-pressure canner registers the proper pressure.

In the steam-pressure canner, do not go above 5 pounds of steam-pressure for fruits, nor over 15 pounds for vegetables.

10. After processing, remove jars or cans immediately, clamp

lid tight if not already sealed and stand upside down in a cool place (not on a cold or wet surface.) Cover with a cloth and be careful not to let a draft strike the hot jars. The shrinkage after cooling should so seal the jars by suction that they may be lifted by the lid or cap. Test them in this way. If the lids come off after cooling, the jars should be re-sterilized. Do not try to screw the lids of screw-cap jars tighter after cooling, as the suction seal is thus liable to be broken and fungous spores and bacteria allowed to enter.

11. Label and wrap the jars in paper or in paper bags, and store in a cool, dry place, not exposed to a freezing temperature.

Time Table for Scalding, Blanching, and Sterilizing of Fruits and Vegetables by one-period cold-pack method

Products	Scald or blanch	*Hot water bath at 212°	Steam pressure-cooker 5 to 10 pounds	Steam pressure-cooker 10 to 15 pounds
FRUITS OF ALL KINDS:	*Min.*	*Min.*	*Min.*	*Min.*
Apricots and Peaches	1 to 2	16	10	5
Blackberries	0	16	10	5
Blueberries	0	16	10	5
Cherries (sweet or sour)	0	16	10	5
Dewberries	0	16	10	5
Grapes	0	16	10	5
Plums	0	16	10	5
Raspberries	0	16	10	5
Strawberries	0	16	10	5
Citrus fruits	1½	12	6	4
Cranberries	0	16	10	5
Currants	0	16	10	5
Gooseberries	0	16	10	5
Rhubarb (blanch before paring)	1 to 2	16	10	5
Apples and Pears	1½	20	8	6
Figs	15	40	25	20
Pineapple	10	30	25	18
Quince	6	40	25	20
SPECIAL VEGETABLES AND COMBINATIONS:				
Tomatoes	1 to 3	22	15	10
Tomatoes and corn	T. 2, C. 10	90	60	45
Eggplant	3	60	45	30
Corn on cob or cut off	5	180	60	45
Pumpkin and Squash	5	90	40	35
Hominy	5	120	60	40
Cabbage or sauerkraut	5	90	60	35
GREENS OR POT HERBS:				
Asparagus	5	120	50	35
Brussels sprouts	5	120	50	35
Cauliflower	5	120	50	35
Pepper cress	15	120	50	35
Lamb's-quarters	15	120	50	35
Sour dock	15	120	50	35

*Based upon one-quart pack. When using pint or half-pint jars, deduct a few minutes from the time specified. When using two-quart jars, add 3 or 4 minutes.

Products	Scald or blanch	Hot water bath at 212°	Steam pressure-cooker 5 to 10 pounds	Steam pressure-cooker 10 to 15 pounds
FRUITS OF ALL KINDS:	*Min.*	*Min.*	*Min.*	*Min.*
Smartweed sprouts	15	120	50	35
Purslane or "pusley"	15	120	50	35
Pokeweed	15	120	50	35
Dandelion	15	120	50	35
Marsh marigold	15	120	50	35
Wild mustard	15	120	50	35
Milkweed (tender sprouts and young leaves)	15	120	50	35
POD VEGETABLES:				
Beans (lima or string)	5	120	60	40
Okra	5	120	60	40
Peas	5	120	60	40
ROOTS AND TUBERS:				
Beets	6	90	60	35
Carrots	6	90	60	35
Sweet potatoes	6	90	60	35
Other roots and tubers, as parsnips or turnips	6	90	60	35
Soups—all kinds	...	90	60	45
SHELLFISH	3	180	90	60
POULTRY AND GAME	20	210	150	60
FISH	5	180	150	90
PORK AND BEEF	30	240	210	90

NOTICES

The Garden is open free to the public daily, from 8 a. m. until sunset; on Sundays and holidays at 10 a. m. The Laboratory Building, containing the library, herbarium, and offices, is open daily, from 9 a. m. until 5 p. m. The Conservatories are open April 1-October 1, 10 a. m.-4:30 p. m.; October 1-April 1, 10 a. m.-4 p. m.

The Garden may be reached by Flatbush Ave. trolley to Malbone St.; Franklin Ave., Lorimer St., and Tompkins Ave. trolleys to Washington Ave.; St. John's Place and Rogers Ave. trolleys to Sterling Place; Vanderbilt Ave., Sixteenth Ave., Union St., Greenpoint, and Smith St. trolleys to Prospect Park Plaza and Union St., and Brighton Beach elevated to Consumers' Park Station. (The elevated trains stop only when the conductor is notified in advance.)

A docent will meet parties by appointment and conduct them through the Garden. This service is free to members of the Botanic Garden and to teachers with classes; to others there is a nominal charge of 25 cents an hour for parties of less than three, and 10 cents a person per hour for parties of three or more.

Current numbers of LEAFLETS are free to all who wish them. Back series, complete, 50c. each; single numbers, 5c. each.

The LEAFLETS are published weekly or biweekly from April to June, and September to October, inclusive, by The Brooklyn Institute of Arts and Sciences, at Washington Avenue and Montgomery Street, Brooklyn, N. Y.

Telephone: 6173 Prospect.

Mail address: Brooklyn Botanic Garden, Brooklyn, N. Y.

BROOKLYN BOTANIC GARDEN

LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES V BROOKLYN, N. Y., SEPTEMBER 12, 1917. NO. 10

TALKS FOR ELEMENTARY SCHOOLS

We have published up to this time two LEAFLETS a year on the subjects we present to elementary school classes. These talks have now settled into such shape that we feel we can consider them as permanent ones. Although these subjects are regarded now as more or less permanent, it does not mean that we are not ready and willing at any time to give a special subject for any group of children or teachers. The subjects laid down correlate with the nature study and geography of the elementary schools of New York City. This correlation was made deliberately because we feel that the Botanic Garden should be of as great aid as possible to the children and schools of this city. It is not possible for any public school to offer to its pupils such advantages as they might have in an institution like the Botanic Garden. It is perhaps possible for a teacher to show her class how to plant bulbs or how to make cuttings as well as we do it here, although even then our facilities are much better than those offered in any class room, but it is quite impossible for any school to have growing in the class room, Coffee Trees or Banana Plants or even enough common trees growing on the school grounds to give the children much of a knowledge of our common deciduous trees or our common evergreens. It has been in our plan from the first to make this Garden a necessary part of the education of the boys and girls of this city, to widen their scope of interest and to make out-doors a well known friend to them.

It will be noted that the third grade is not provided for, or those grades below that. We have found that the younger children get far less out of this work and it hardly seems advisable to take our time or the time of their teachers for something which does not seem, at least in our own eyes, to be helpful and vital. Third grades will however be taken through the green houses and through the Japanese Gardens under

guidance. Large groups of children, or even small groups, may not go unattended through the green houses or the Japanese Garden. We wish the children of this city to feel that this Garden is not a playground, but it is a place where boys and girls come to receive something in education which they can obtain in no other place.

There seems to be an opinion current that the larger the numbers of children flocking to an institution, the greater the work must be. We do not feel this to be true. We purposely limit the number of classes we are willing to take in a group. We do not believe you can educate in masses, and so after children have had their lecture here on a special subject they are divided into groups, these groups having not more than fifteen children in each. In this way the fifteen can gather round a teacher and really learn something about what they see. If the group is too large, the benefit of our work is lost. A large group of children was listening to a talk at the entrance of the Japanese Garden and were told of the significance of the Moon View House. Later when the children wrote a composition at school upon the Japanese Garden, one boy said that the Moon View House was a place where the moon sits at night. This is typical of what children absorb from mass teaching. We suggest that no school send more than one hundred children at any one time. One school sent one grade to all the talks of that grade during one spring. We felt that having the same group of children once a week for four weeks was worth a great deal both to the children and to us. Another school felt it more important and helpful to send different classes and during that spring this school, P. S. 43, sent classes to hear all of our talks. The method of using the Botanic Garden to the greatest advantage is, of course, a problem for the individual school.

The following topics are our subjects chosen for spring and fall work:

FALL SUBJECTS

Grades 4A and 4B

1. Cultivations of plants by seeds, slips, runners, etc. (Greenhouse).
2. What plants need for growth. (Experiments).
3. Plant variations in the hot, cold and temperate countries. (Lantern slides and specimen plants).
4. The cultivation of rice in China and Japan. (Lantern slides).
5. How boys and girls can help make Brooklyn a more beautiful city. (Lantern slides).

Grades 5A and 5B

6. How to plant bulbs for winter bloom. (Demonstration).
7. Plant foods raised in the United States. (Lantern slides).
8. How nature disperses her seeds. (Demonstration).
9. Useful plant products. (Lantern slides).

10. How to distinguish common evergreens. (Study of the trees themselves).

GRADES 6A AND 6B

11. The classroom window box. (Demonstration).
12. Coffee culture in South America. (Lantern slides).
13. How rubber is obtained. (Lantern slides).

GRADES 7A AND 7B

14. Plants for classrooms and care of same. (Demonstration).
15. Agricultural products of the United States. (Lantern slides).
16. What plants mean to the world's commerce. (Lantern slides).
17. The life story of a tree. (Demonstration and slides).
18. Elementary Forestry.

NOTE.—It is suggested that when such talks as 1, 6, 10 and 11 are desired that the groups be made so that the individual child may asssist in the lesson. If no more than fifty children are in the section, this may be divided into two small groups, and each child will be able to work and take away with him to his classroom and home the intimate knowledge thus gained. The above talks will be given only at the Brooklyn Botanic Garden, where the greenhouses, economic plants and the grounds make it possible to acquaint the children with the living material. **Principals and teachers should make appointments for classes at least one week in advance. These talks are listed by grades to correlate with the city syllabus in nature study and geography.** Any talk will be given to any class of either public or private schools, regardless of this grading.

SPRING SUBJECTS

ALL GRADES

1. How to plant a garden. (Lantern slides and demonstration.
2. Our common trees. (Lantern slides and outdoor work).
3. Some of our native wild flowers which bloom in April, May and June. (Slides and specimens).
4. How to make Brooklyn a more beautiful city. (Lantern slides).

GRADES 4A AND 4B

5. Cultivation of plants by seeds, slips, runners, etc. (Greenhouses).
6. What plants need for growth. (Experiments).
7. Plant variations in the hot, cold, and temperate countries. (Lantern slides and specimen plants).
8. The cultivation of rice in China and Japan. (Lantern slides).

GRADES 5A AND 5B

9. Plants useful to man. (Lantern slides and living plants).
10. Evergreens and deciduous trees. (Botanic Garden grounds, May-June).
11. Food plants raised in the United States. (Lantern slides).
12. Plant industries and products of the United States. (Lantern slides).
13. Cotton raising in the South. (Lantern slides).

GRADES 6A AND 6B

14. Coffee culture in South America. (Lantern slides and living plants).
15. The rubber industry in South America. (Lantern slides and living plants).
16. The classroom window box. (Demonstration).

GRADES 7A AND 7B

17. Agricultural products of the United States. (Demonstration).
18. What plants mean to the world's commerce. (Lantern slides).
19. The life history of a tree. (Demonstration and slides).
20. Forestry. (Lantern slides).

TO BE GIVEN AT SCHOOLS

ALL GRADES

How to make a garden and prepare for the Annual Children's Garden Exhibit, to be held at the Botanic Garden.

This season's fall talks will be given from October 1 to November 9, 1917. The spring talks of 1918 are listed for April 15 to May 29. Cards should be made out and sent to the Garden at least one week before a given class wishes its appointment. Such cards may be obtained by writing to Ellen Eddy Shaw, Curator of Elementary Instruction, Brooklyn Botanic Garden.

ELLEN EDDY SHAW.

NOTICES

The Garden is open free to the public daily, from 8 a. m. until sunset; on Sundays and holidays at 10 a. m. The Laboratory Building, containing the library, herbarium, and offices, is open daily, from 9 a. m. until 5 p. m. The Conservatories are open April 1–October 1, 10 a. m.–4:30 p. m.; October 1–April 1, 10 a. m.–4 p. m.

The Garden may be reached by Flatbush Ave. trolley to Malbone St.; Franklin Ave., Lorimer St., and Tompkins Ave. trolleys to Washington Ave.; St. John's Place and Rogers Ave. trolleys to Sterling Place; Vanderbilt Ave., Sixteenth Ave., Union St., Greenpoint, and Smith St. trolleys to Prospect Park Plaza and Union St., and Brighton Beach elevated to Consumers' Park Station. (The elevated trains stop only when the conductor is notified in advance.)

A docent will meet parties by appointment and conduct them through the Garden. This service is free to members of the Botanic Garden and to teachers with classes; to others there is a nominal charge of 25 cents an hour for parties of less than three, and 10 cents a person per hour for parties of three or more.

Current numbers of LEAFLETS are free to all who wish them. Back series, complete, 50c. each; single numbers, 5c. each.

The LEAFLETS are published weekly or biweekly from April to June, and September to October, inclusive, by The Brooklyn Institute of Arts and Sciences, at Washington Avenue and Montgomery Street, Brooklyn, N. Y.

Telephone: 6173 Prospect.

Mail address: Brooklyn Botanic Garden, Brooklyn, N. Y.

BROOKLYN BOTANIC GARDEN

LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES V BROOKLYN, N. Y., OCTOBER 3, 1917 No. 11

FALL TREATMENT OF LAND FOR GARDEN CROPS

It is often advantageous to commence the preparation of the soil for spring planting in the preceding autumn. **Sod land** which is proposed to be converted into a vegetable or flower garden should always be dug or plowed in the fall, if possible, in order that the tough roots and wiry stems of the grasses may have more time in which to decay, thus forming plant food and improving the physical condition of the soil.

Although it is true that crops can be produced on sod that has been dug or plowed in the spring, the results are not nearly so satisfactory as in the case of land plowed the preceding fall. In the first place it is practically impossible to form a good seed bed in ground that is full of intractable lumps. Also difficulties are experienced when the sods commence to grow (as they surely will !); and, further, the loose, undecayed sods, by providing a bar to efficient capillary action, are likely to dry out too rapidly and cause the crops to suffer from lack of moisture.

It is advisable to turn under the sods early in the fall, when the ground is still warm, as decay proceeds more rapidly in a moderately high temperature. If stable or farm yard manure is available, it may be spread over the ground to a depth of about three inches.

The ground is now ready to be dug or plowed. If the work is to be done by hand, first make a trench across one end of the plot a foot wide and a foot deep. Now proceed with the digging of the plot, burying the sods and manure in the trench. You will find it much easier by this method than if no trench has been made. The soil made by opening up the first trench is used to fill in at the oppo-

site end of the plot when digging is finished. When all is finished, lime may be applied to advantage, scattering it over the surface and then raking or harrowing it in. Use from thirty to forty pounds of air-slaked lime or good ground limestone on a plot 20x40 feet. If no manure is used, the lime may be spread over the surface before the ground is dug, but it is not advisable to apply lime directly in contact with manure as it may result in the rapid liberation of ammonia from the manure in the form of gas and thus much of its fertilizing value will be wasted.

The treatment of the ground the following spring will depend on circumstances; if the sods and manure have thoroughly decayed it will be advisable to dig the plot over again. If they are only partly decayed, it will be better to leave them buried and be content with chopping up any surface weeds with a hoe and loosening the top soil with a rake so as to provide a good seed bed.

Clay soils.—Heavy clay soils are improved by being dug up in the autumn and left with the surface rough so that the frost has a chance to penetrate. Freezing breaks up the heavy, sticky clay, causing it to crumble, and greatly improves its physical condition. Liming, also, is of great value to clay soils as, apart from its value as a fertilizer and a corrector of soil acidity, lime flocculates the clay particles, rendering the soil more open and pervious to water. Stable manure, especially if it contains much straw, is also of great value for lightening heavy soils. It should be applied in the autumn, burying it as deeply as possible. Clay soils that have been thoroughly plowed and fertilized in the autumn will be ready for planting the following spring after the surface has been leveled and fined by the use of harrow or rake. It is important not to walk on heavy soils more than is absolutely necessary especially when they are wet, as this results in further consolidating them and making it still more difficult for the plant roots to penetrate. One of the great disadvantages of heavy soils is the slowness with which they dry out and warm up in the spring. By preparing the ground in the preceding autumn, much time is saved in the spring; the soil dries out more rapidly and it is possible to commence planting earlier than would otherwise be the case.

Sandy soils.—As a general thing, it is not a good plan to dig or plow sandy land in the autumn. Such soils are not very retentive of plant foods and the result of fall plowing is the loss of some fertility by leaching. Under some circumstances, however, the fertility and physical condition of sandy soils can be greatly improved by digging them early in the fall and planting a crop of rye or hairy vetch, to be plowed under the following spring.

This practice is known as "green manuring". In such cases the ground should be dug up about the middle of September,

raked moderately level and the seed of the cover crop sown on the surface. The ground should then be raked over so as to cover the seed as much as possible. It is a good plan after planting to spread a thin layer of stable manure (about two inches thick) over the ground. This will add fertility and protect the cover crop during the winter. A plot 20x40 feet will require about 1 pound of winter vetch (hairy vetch) or 2 or 3 pounds of rye. The two crops may also be planted together, using half the quantity of each. In the spring when the rye is from 6 inches to 1 foot in height, it should be dug under, first spreading lime over the surface at the rate of 40 pounds to 800 square feet. By this method the soluble fertilizing elements of the soil are not lost by leaching but are taken up by the cover crop and returned to the soil again when dug in.

The practice of green manuring is a valuable method of adding humus to the soil, especially in those sections where it is difficult or impossible to obtain stable or barnyard manure. Green manuring may be practiced on clay and sandy soils to equal advantage, but to secure best results it must be supplemented by the use of concentrated fertilizers or stable manure. A good plan is to apply a "complete", concentrated fertilizer, obtainable from most seedsmen, to the soil immediately after the green crop has been buried, thoroughly raking the surface to mix and evenly distribute the fertilizer.

The main advantages of the preparation of land in the autumn may be summed up as follows:

In the case of grass land, the sods have opportunity to decay before planting time. Clay soils are more readily penetrated by frost, which assists in breaking the clods and renders the soil more amenable to cultivation, and thus enables planting to be accomplished earlier.

In the case of sandy soils, it offers an opportunity of growing a crop for green manuring, which adds fertility, improves the physical condition, and prevents leaching of soluble plant foods.

Another advantage that will be appreciated by those in the city who experience difficulty in obtaining decayed manure, is that manure fresh from the stable may be used in the fall with good results to the crop the following year, and without creating a nuisance to one's self and neighbors.

MONTAGUE FREE.

NOTICES

The Garden is open free to the public daily, from 8 a. m. until sunset; on Sundays and holidays at 10 a. m. The Laboratory Building, containing the library, herbarium, and offices, is open daily, from 9 a. m. until 5 p. m. The Conservatories are open April 1–October 1, 10 a. m.–4:30 p. m.; October 1–April 1, 10 a. m.–4 p. m.

The Garden may be reached by Flatbush Ave. trolley to Malbone St.; Franklin Ave., Lorimer St., and Tompkins Ave. trolleys to Washington Ave.; St. John's Place and Rogers Ave. trolleys to Sterling Place; Vanderbilt Ave., Sixteenth Ave., Union St., Greenpoint, and Smith St. trolleys to Prospect Park Plaza and Union St., and Brighton Beach elevated to Consumers' Park Station. (The elevated trains stop only when the conductor is notified in advance.)

A docent will meet parties by appointment and conduct them through the Garden. This service is free to members of the Botanic Garden and to teachers with classes; to others there is a nominal charge of 25 cents an hour for parties of less than three, and 10 cents a person per hour for parties of three or more.

Current numbers of LEAFLETS are free to all who wish them. Back series, complete, 50c. each; single numbers, 5c. each.

The LEAFLETS are published weekly or biweekly from April to June, and September to October, inclusive, by The Brooklyn Institute of Arts and Sciences, at Washington Avenue and Montgomery Street, Brooklyn, N. Y.

Telephone: 6173 Prospect.

Mail address: Brooklyn Botanic Garden, Brooklyn, N. Y.

CATSKILLS AQUEDUCT CELEBRATION NUMBER (October 12—15,1917)

BROOKLYN BOTANIC GARDEN

LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES V BROOKLYN, N. Y., OCTOBER 10, 1917 NOS. 12 and 13

FOREST PROBLEMS OF THE ASHOKAN WATERSHED

One of the most important problems in the administration of a great city like New York is the water supply. At least three things are essential: 1. A continuous and abundant source of water; 2. A reservoir of adequate size and elevation whence the water can be distributed; 3. The maintenance of the water and the watershed in a condition of as perfect sanitation as possible.

For an adequate supply of water it is necessary, not only to have a suitable amount of precipitation, but to insure the conservation of as much of the rainfall as possible to the run-off draining into the reservoir. If the fallen rain evaporates too fast from the watershed, the reservoir is inadequately supplied. It is also desirable that the drainage into the reservoir be as evenly distributed throughout the year as possible, otherwise the water may get too low at certain seasons of comparative drought.

The principal factor in realizing these two needs is the vegetation, and especially the trees of the watershed. The old supposition that trees increase the amount of rainfall has been conclusively shown to be fallacious. It has been shown with equal or greater certainty that forests increase the humidity and thus decrease the rate of evaporation; and it is also known that the run-off from a forested area is more gradual and more evenly distributed through a given period of time than from an area devoid of trees.

For these and other reasons it is highly essential to maintain proper forest conditions on the watershed of any municipal water supply system. Thus, after the rainfall is assured, and the reservoir and aqueduct are constructed, there still remains one of the most important problems of all, namely, to secure and to maintain

a forest on the watershed. This involves at least three things: 1. Planting the trees; 2. Giving them adequate care; 3. Removals and replacements, or, in other words, scientific forest management.

After the kind of trees is decided upon, suited to the given climate, the planting is comparatively easy; but from that time on problems arise which require the constant oversight of a trained forester, and of a specialist in the treatment of tree diseases. Unfortunately these last needs, of a forester and a plant pathologist, are too frequently overlooked or ignored.

The land controlled by New York City on the Ashokan watershed comprises a total of over 15,000 acres. Less than half of this area bears a native forest of second growth white oak, red oak, red maple, sugar maple, hemlock and white pine. Chestnut trees were plentiful until the chestnut bark disease began, about ten years ago, to kill the trees, and there are few of them left. The dead and dying ones are being cut down and should, of course, be replaced with other species.

The City has already planted on this watershed about one and a half million cone-bearing (evergreen) trees, more than one million of which include six species of pine. The present value of the trees is probably not far from one million dollars, and is increasing each year. They are also becoming annually more and more important conservators of the city's water supply.

Every one of these species is subject either to insect ravages or to diseases caused by parasitic fungi. Within three or four years there has been imported into this country, from Europe, a rapidly spreading disease that is destructive to certain species of pines. This disease has already reached the area of the Ashokan watershed, and, up to the present time, no effective treatment is known. Infected trees should at once be cut down and burned. This disease is cited merely as an illustration. It threatens to destroy every one of the million or more trees planted by the City at large expense, and vital to its water supply. It has long since been too late to save the chestnuts, as no remedy for chestnut bark disease is known. The public is fairly familiar with the forest ravages of insects.

It is the purpose of these few paragraphs merely to call attention to these facts, and to urge, with all possible emphasis, the necessity of the City appointing a competent plant pathologist, whose business should be not alone to act as a practicing physician of trees, diagnosing, and applying remedies worked out by others, but devoting much of his time and energies to scientific research into the nature and causes of tree diseases, so that he may be able to contribute toward the solution of the problem of their control. He should have a laboratory properly equipped for

the most thorough scientific research, and a suitable staff of trained assistants.

Hundreds of thousands, possibly in the course of time, millions of dollars worth of City property, as well as the proper protection of the water supply, may be insured by the comparatively small annual cost of maintaining such a laboratory.

Moreover, for its own best interests, the forest-to-be on this watershed will not only need continual removals and replacements, but this process may and should become, by judicious forest management, a source of income to the city, much more than sufficient to meet the entire cost of upkeep of both forest and reservoir. For this work a thoroughly trained and experienced forester is necessary, with a corps of assistants.

The City has no more important problem in connection with its new water supply, for here lies one of the indispensable conditions to maintaining not only the abundance but the purity of the drinking water of over five million human beings.

C. Stuart Gager.

PLANTS OF THE CATSKILL AQUEDUCT REGION

From near sea-level to the highest mountains within 100 miles of the City stretches the Catskill Water system, and this diversity of elevation suggests at once a division of the plant life of the area into the mountain and low-land types of vegetation. This may not be such an artificial division as at first sight appears when it is remembered that many of our local wild flowers are found only on the mountain-tops of the Catskills or at elevations in excess of 1,500 feet. Others, again, common enough near the mouth of the Hudson, seem to creep rather sparingly up the Valley, perhaps as far as the Highlands, only to find these hills a barrier to a more northerly journey.

There are many striking illustrations of these well marked tendencies of plant distribution in the region. For instance, near the mouth of the Croton River there is a tree of the yellow pine (*Pinus echinata*), more than fifty miles north of its usual home, near the pine-barrens of New Jersey. And on the Palisades, opposite Yonkers, there grew, until quite recently, large masses of the native yew (*Taxus canadensis*), otherwise at home in the highland region northward. Near Peekskill Bay and just below it on Verplanks Point are many specimens of the ninebark (*Physocarpus opulifolius*), which, while it is common enough

northward, is rare or wanting below this in the Valley. Near Judge Parker's estate at Esopus is an island, without name, upon which occur the most southerly specimens of the arbor vitae (*Thuja occidentalis*) in the Aqueduct region. Near Piermont, just below Nyack, are large quantities of marsh fleabane (*Pluchea camphorata*), on what are locally called the "Flats". This plant is obviously an intruder from the salt marshes of the Long Island and New Jersey coasts.

Scores more of these exceptions could be cited to prove the general rule that the flora of the Catskill Aqueduct region is of two types. It is true that they intergrade somewhat, but on the whole the Highlands seem to act as a barrier to many of our wild plants, particularly to the mountain species, some of which have never been known to occur in the valley south of Storm King or Anthony's Nose. It is through the former that the aqueduct takes the great plunge under the Hudson to the east bank of the river.

THE MOUNTAIN PLANTS

No real alpine conditions are found in the Catskills, the highest peak being scarcely over 4,000 feet. But there are many peaks that are over 2,000 feet, and toward the summit of these, and on the top of Slide Mountain, there occurs a group of plants that are found practically nowhere else in the Aqueduct tract. Some of the more conspicuous of them are:

Braun's Polystichum (*Polystichum Braunii*), a strong growing fern, growing in rocky woods.

Balsam Fir (*Abies balsamea*), the tree of fragrant memory, common enough near the head-waters of Esopus Creek, unknown in the low-lands.

Wood Reed Grass (*Cinna latifolia*); besides the Catskills it has been found at Pine Plains, Dutchess county.

Several species of sedge, which are plants with the general aspect of grass, notably *Carex novae-angliae*.

Mountain Yellow-eyed Grass (*Xyris montana*), known only from the highest regions of the Catskills, in our area.

Mountain Strawberry (*Fragaria canadensis*), and its relative *Fragaria terra-novae*, both isolated on the highest peaks in the watershed of the Ashokan Reservoir.

Mountain Ash (*Pyrus sitchensis*), differing from the common mountain ash in its short-pointed leaves. The latter is common in many places in the valley, but *P. sitchensis* is found only at the highest elevations.

Violet (*Viola Selkirkii*), known, in the Catskill region, only from near mountain summits, and usually only above 2,500 feet where another species, peculiar to high elevations, *Viola renifolia*, is also found.

One-flowered Wintergreen (*Moneses uniflora*), with small white flowers in June. Found in the Adirondacks and nearly to

the Arctic Circle, but reaching nearest to New York City in the Catskills.

Canadian Blueberry (*Vaccinium canadense*), a low bush not over eighteen inches tall, with leaves bright green on both sides, and nearly evergreen.

Adoxa (*Adoxa Moschatellina*), remarkable because it is found in New York State only near Arkville, Delaware county, on mountains that drain into the upper portion of Ashokan reservoir.

Large-leaved Golden-rod (*Solidago macrophylla*), reaching its most southerly distribution point on the highest peaks of the Catskills, and found far northward in the Hudson Bay region.

There are a few others of these essentially far-northern species that find their most southerly outposts in the higher elevations of the water system of Ashokan, bringing such species nearer to the City than anywhere else the plants occur. It would be a fitting permament memorial of the completion of the water system if the City could acquire some tract near the Ashokan reservoir containing these rare plants and thus preserve them.

At somewhat lower elevations, in fact nearly throughout the Catskills and in the higher elevations of the Hudson Highlands, are many other species that are rare or wanting along the lower stretches of the Hudson nearer sea-level. Among the most beautiful of these are:

Clintonia (*Clintonia borealis*), with yellow flowers and glossy basal leaves.

Green Orchis (*Habenaria hyperborea*), with spurred, irregular, greenish-white flowers.

Showy-fringed Orchid (*Habenaria grandiflora*), with very striking purple-fringed flowers in July.

White Adders-Mouth (*Microstyles monophyllos*), a small orchid with whitish flowers.

Coral-root (*Corallorhiza trifida*), a slender saprophytic orchid with whitish stems and flowers, but no leaves.

Northern Stitchwort (*Stellaria borealis*), a white-flowered chickweed-like herb found on wet rocks and flowering in summer.

Mountain Sandwort (*Arenaria groenlandica*), making small tufts in rocky places. Flowers white, in summer.

Foam Flower (*Tiarella cordifolia*), with beautiful white flowers in May and June, so plentiful as to suggest its common name. Found very sparingly below Peekskill, if at all.

Purple or White Avens (*Geum rivale*), with not very numerous flowers, and tassel-like, silky fruits.

Barren Strawberry (*Waldsteinia fragarioides*), a strawberry-like plant with white flowers, and dry fruits. Leaves nearly evergreen.

Ginseng (*Panax quinquefolium*), known only from Haverstraw Bay northward. Formerly much collected for its supposed medicinal qualities, and now nearly extinct in the region.

Labrador Tea (*Ledum groenlandicum*), a low bog shrub with russet foliage and white flowers. Known only from Dutchess county northward.

Three-leaved Solomon's Seal (*Smilacina trifolia*), very rare in the Hudson Valley in Dutchess county; unknown south of it.

Twisted-Stalk (*Streptopus amplexifolius*), with greenish-white flowers and leaves bluish beneath. Known only from the Catskills.

Showy Ladies' Slipper (*Cypripedium reginae*), the finest of all the ladies' slippers. Flowers white, variegated with crimson stripes. From Dutchess county and northward.

Round-leaved Orchis (*Habenaria orbiculata*), has two large, nearly round leaves, flat on the ground. They are silvery beneath.

Rattlesnake Plantain (*Epipactis tesselata*), a small orchid with variegated leaves and whitish flowers on slender spikes.

Golden Seal (*Hydrastis canadensis*), now known only from near West Point and northward; very rare. Formerly much collected for its medicinal roots.

Anemone (*Anemone riparia*), known only from Dutchess county in our area.

Hepatica (*Hepatica acutiloba*), a pointed-leaved form of this common wild flower in the Aqueduct region only from the Catskills.

Three-toothed Cinquefoil (*Potentilla tridentata*), a white-flowered herb with a woody base, the leaflets toothed at the end. Found only from Dutchess county and the Catskills.

Seneca Snakeroot (*Polygala Senega*), sometimes called mountain flax. Flowers in long, slender spikes; white, tinged with green.

Giant St. John's Wort (*Hypericum Ascyron*), almost a shrub, with large yellow flowers. Grows in moist places, only in the Catskills in the Hudson Valley region.

Dwarf Cornel (*Cornus canadense*), its greenish-white bloom, suggestive of minature dogwood, is borne at the end of the stems which are scarcely over four inches tall. Known now only from the Highlands northward.

Ague-weed (*Gentiana quinquefolia*), somewhat like the common fringed gentian but without the fringe. Rare in northern Westchester county, and increasing northward through the Highlands to the Catskills.

Bugle-weed (*Lycopus membranaceus*), with the aspect of mint, but without the mint odor. Known only from the Catskill area.

Hobble-bush (*Viburnum alnifolium*), a shrub with showy white flowers and red fruits. Common north of the Highlands at moderate elevations and in the Catskills.

Swamp Laurel (*Kalmia polifolia*), a small relative of the

mountain laurel which is scattered all along the water system. *K. polifolia* is a bog shrub with two-edged twigs and known only from Dutchess county northward.

Wild Rosemary (*Andromeda glaucophylla*), a low bog shrub with white drooping flowers and whitish foliage, known in the region only from Orange and Putnam counties northward.

Van Brunt's Jacob's-Ladder (*Polemonium Van Bruntiae*), a blue showy herb found in the Catskills, but scarcely south of them in the water system.

Oswego Tea (*Monarda didyma*), commonly cultivated but apparently wild only in the Catskills, so far as our region is concerned. Flower scarlet and showy.

Twin-flower (*Linnaea borealis*), a low-carpeting plant with twin-flowers. Rare or wanting now south of the Highlands, although there are old records of it from Long and Staten Islands.

Wood Valerian (*Valeriana uliginosa*), a pink or white flowered herb known only from the northern end of the Highlands northward.

Scores more of these northern species of plants could be cited, but space forbids more support of the general thesis that the Catskill water system cuts through two distinct floral regions. Many trees, such as the spruce, larch, and bur oak and a considerable number of shrubs follow the same general distributional tendency as the herbs, their occurrence south of Peekskill being very rare or unknown. The few exceptions mentioned earlier only serve to prove the rule.

THE LOWLAND PLANTS

Of the 2,038 native flowering plants found wild within 100 miles of the City, about 1,600 are found in the Hudson Valley and Catskill regions.

Deducting those that we have seen to be of northern tendencies, there remain a large number of species that make up the great bulk of vegetation of these regions. These generally distributed plants are too numerous to mention here. Wherever the vegetation has been undisturbed, as through the Highlands, it is still a forest region with a wealth of wild flowers and ferns and shrubs as undergrowth. In spite of the wealth of plants, there appears to be no species endemic there, i. e., found nowhere else.

As illustrating the tendency of many essentially lowland plants not to grow north of the Highlands the sweet-gum (*Liquidambar Styraciflua*), sour gum (*Nyssa sylvatica*), and tulip tree (*Liriodendron tulipifera*) are interesting. All are common near the City and south of it. The first has never been recorded north of Peekskill, *Nyssa* is very rare north of the Highlands, while the Tulip Tree is unknown as a wild tree in the Catskills.

Perhaps the most beautiful of all the shrubs of the Catskill aqueduct system is the mountain laurel (*Kalmia latifolia*), whose white or pinkish flowers color great areas in the Highlands and at some other places, usually about Memorial Day. Among the trees, the dogwood (*Cornus florida*), with its white showy bloom, is among the commonest in the wilder parts of the country.

NORMAN TAYLOR

NOTICES

The Garden is open free to the public daily, from 8 a. m. until sunset; on Sundays and holidays at 10 a. m. The Laboratory Building, containing the library, herbarium, and offices, is open daily, from 9 a. m. until 5 p. m. The Conservatories are open April 1-October 1, 10 a. m.-4:30 p. m.; October 1-April 1, 10 a. m.-4 p. m.

The Garden may be reached by Flatbush Ave. trolley to Malbone St.; Franklin Ave., Lorimer St., and Tompkins Ave. trolleys to Washington Ave.; St. John's Place and Rogers Ave. trolleys to Sterling Place; Vanderbilt Ave., Sixteenth Ave., Union St., Greenpoint, and Smith St. trolleys to Prospect Park Plaza and Union St., and Brighton Beach elevated to Consumers' Park Station. (The elevated trains stop only when the conductor is notified in advance.)

A docent will meet parties by appointment and conduct them through the Garden. This service is free to members of the Botanic Garden and to teachers with classes; to others there is a nominal charge of 25 cents an hour for parties of less than three, and 10 cents a person per hour for parties of three or more.

Current numbers of LEAFLETS are free to all who wish them. Back series, complete, 50c. each; single numbers, 5c. each.

The LEAFLETS are published weekly or biweekly from April to June, and September to October, inclusive, by The Brooklyn Institute of Arts and Sciences, at Washington Avenue and Montgomery Street, Brooklyn, N. Y.

Telephone: 6173 Prospect.

Mail address: Brooklyn Botanic Garden, Brooklyn, N. Y.

BROOKLYN BOTANIC GARDEN

LEAFLETS

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES

SERIES V BROOKLYN, N. Y., OCTOBER 17, 1917 NO. 14*

AUTUMN COLORS

"October! the foliage becomes a royal crown, decking
Nature with mingled hues of green and gold and red."

In our own section of the country, but perhaps even more in New England and Eastern Canada, occurs perhaps the most brilliant fall coloring in the whole world. Some think that this is largely because of the abundance of Maples, but it is also largely because of our bright fall; for bright, clear autumn weather, combined with an abrupt transition from summer to autumn, is essential to the best coloration.

The following account of just how this wonderful phenomenon is brought about has been adapted largely from the writings of Professor W. F. Ganong of Smith College.

All autumnal coloration of foliage comes from the following five colors, occurring either singly or in combinations, modified sometimes by other substances:

1. **Green**, from the *chlorophyll* (meaning "leaf green") which colors all green plants and which has the well-known and vastly important function of manufacturing starch from water and carbon dioxide. Indeed, in the very last analysis, this remarkable process lies at the very basis of all plant and animal food. The green persists all winter in pines and spruces and other evergreens, generally fading but little; but in deciduous trees it disappears in dying leaves early in the fall, or sometimes even in summer when a branch becomes injured in any way, and yellows and reds then appear. Our prevailingly bright, clear autumn weather produces a quicker and fuller fading of the green than in Old England, for instance, where moisture and clouds prevail during the fall. The quick fading of the green, followed by the sudden appearance of the yellows and reds, as well as the deep-

*This is the final LEAFLET of Series V. Series VI will begin in April, 1918.

ness and brilliancy of the reds, are, in fact, closely correlated with the sudden ending of our northern summers and the quick coming of our bright autumn skies.

It is obvious that frost may help somewhat in fall coloring by abruptly checking the vitality of the leaves and thus hastening the disappearance of the green, but they do not, as is sometimes popularly believed, really cause fall colors. For these colors, as we well know, generally appear long before frosts. Further, the chlorophyll itself does not, as was once thought, break up into various colors, but instead fades away entirely as the leaf dies, precisely as it would in an alcoholic solution of the green, when exposed to a strong light.

2. **Yellow.** Mixed with the chlorophyll in healthy leaves occur constantly two or perhaps more yellow pigments, collectively called *xanthophyll* (meaning "leaf yellow"). These serve an unknown function, but their constancy indicates that they play an important part in the vital activities of the leaf. The normal green color of leaves is in fact never a perfectly pure green, but it always tends more or less toward yellow, especially in unhealthy leaves, or in those of waning vitality. Strong light does not effect these yellow pigments as readily as it does the chlorophyll; so that after the fading of the green color, the more stable yellows often persist for a long time in full intensity. This greater stability is strikingly shown by placing a fresh solution of leaf pigments, made by soaking green leaves in alcohol, in strong sunlight. Even in an hour or so the strong light causes the green color to fade, leaving the solution yellow. This experiment shows clearly just why leaves turn yellow in autumn; for the fading of the chlorophyll in bright light from dying leaves results in the exposure of the yellow always present. Yellow is therefore the most common of the autumn colors.

3. **Red.** Less abundant than yellow as an autumn color but more conspicuous is red, due to the presence of pigments termed collectively *erythrophyll* ("leaf red"). Being soluble in the watery cell sap, the color is readily dissolved out by heating red autumn leaves in water. Erythrophyll is not ordinarily previously present in autumn leaves as was xanthophyll but it is made from various substances in solution during the fading of the chlorophyll. So far as we know, this red coloring matter is of no particular use in the leaf, but it arises incidentally, apparently as a chemical accident. This autumn red, so far as we know, is exactly similar to the red color in Japanese Maple, Copper Beeches, Coleus, Beets and Red Cabbages. In some of these cases, it is so abundantly dissolved in the cell sap as to cover up entirely the green. In the case of autumn leaves, it seems to be necessary that sugar be present in leaves, and probably tannin, in order to result in an abundance

of red. Bright light is also essential to the process, as is proved by the fact that any leaf which ordinarily turns red does not do so if closely covered by another. Apparently the fading away of the chlorophyll admits a sufficient intensity of light to produce in the sugary sap the proper chemical reaction. The reason why some leaves turn red and others only yellow appears to be simply because some kinds contain sugar at the time the chlorophyll fades and other kinds do not. If sugar is plentifully present, and if favorable light strikes the leaf, red will result in such abundance as to obscure the yellow; but if little or no sugar be present, yellow only results. It therefore seems clear that the appearance of the red in autumn foliage is a chemical incident, dependent upon the presence of sugar. The Maples, Oaks, Sumacs and Dogwoods are noted either for their abundance of sugar, or of tannin, or of both; they have therefore the reddest of autumn foliage.

4. **Brown.** This color also has no functional use, so far as we know, but simply results from certain chemical or physical conditions which prevail in the dying or dead leaves. In some dying leaves it is apparently a product resulting from the oxidation of yellow substances in the cell sap; in others, it results from oxidation of tannins present in cell walls. Similarly, wood and bark turn brown in time due to the effect of light and air on the tannin they contain. When the browning takes place not too rapidly, it sometimes combines with the yellow of xanthophyll into a beautiful golden bronze, as in some Oaks. With the brown, as with other colors, the exact shade is often determined by the degree of mixture with other substances, such as resins, or with reds or remnants of unfaded chlorophyll.

5. **White,** the rarest of all in autumn coloration, is the natural color of the bleached-out leaf structure, much as cotton is white. In our Birches, for instance, the fading first of the green, then of the yellow, leaves the tissues finally nearly white.

It is thus seen that not one of the so-called autumn colors really serves any useful function, for they all result from the various chemical and physical changes that go on during the slow dying and fall of the leaves. Though but incidental, they are nevertheless happy incidents for mankind, contributing greatly to human enjoyment.

E. W. O.

NOTICES

The Garden is open free to the public daily, from 8 a. m. until sunset; on Sundays and holidays at 10 a. m. The Laboratory Building, containing the library, herbarium, and offices, is open daily, from 9 a. m. until 5 p. m. The Conservatories are open April 1–October 1, 10 a. m.–4:30 p. m.; October 1–April 1, 10 a. m.–4 p. m.

The Garden may be reached by Flatbush Ave. trolley to Malbone St.; Franklin Ave., Lorimer St., and Tompkins Ave. trolleys to Washington Ave.; St. John's Place and Rogers Ave. trolleys to Sterling Place; Vanderbilt Ave., Sixteenth Ave., Union St., Greenpoint, and Smith St. trolleys to Prospect Park Plaza and Union St., and Brighton Beach elevated to Consumers' Park Station. (The elevated trains stop only when the conductor is notified in advance.)

A docent will meet parties by appointment and conduct them through the Garden. This service is free to members of the Botanic Garden and to teachers with classes; to others there is a nominal charge of 25 cents an hour for parties of less than three, and 10 cents a person per hour for parties of three or more.

Current numbers of LEAFLETS are free to all who wish them. Back series, complete, 50c. each; single numbers, 5c. each.

The LEAFLETS are published weekly or biweekly from April to June, and September to October, inclusive, by The Brooklyn Institute of Arts and Sciences, at Washington Avenue and Montgomery Street, Brooklyn, N. Y.

Telephone: 6173 Prospect.

Mail address: Brooklyn Botanic Garden, Brooklyn, N. Y.